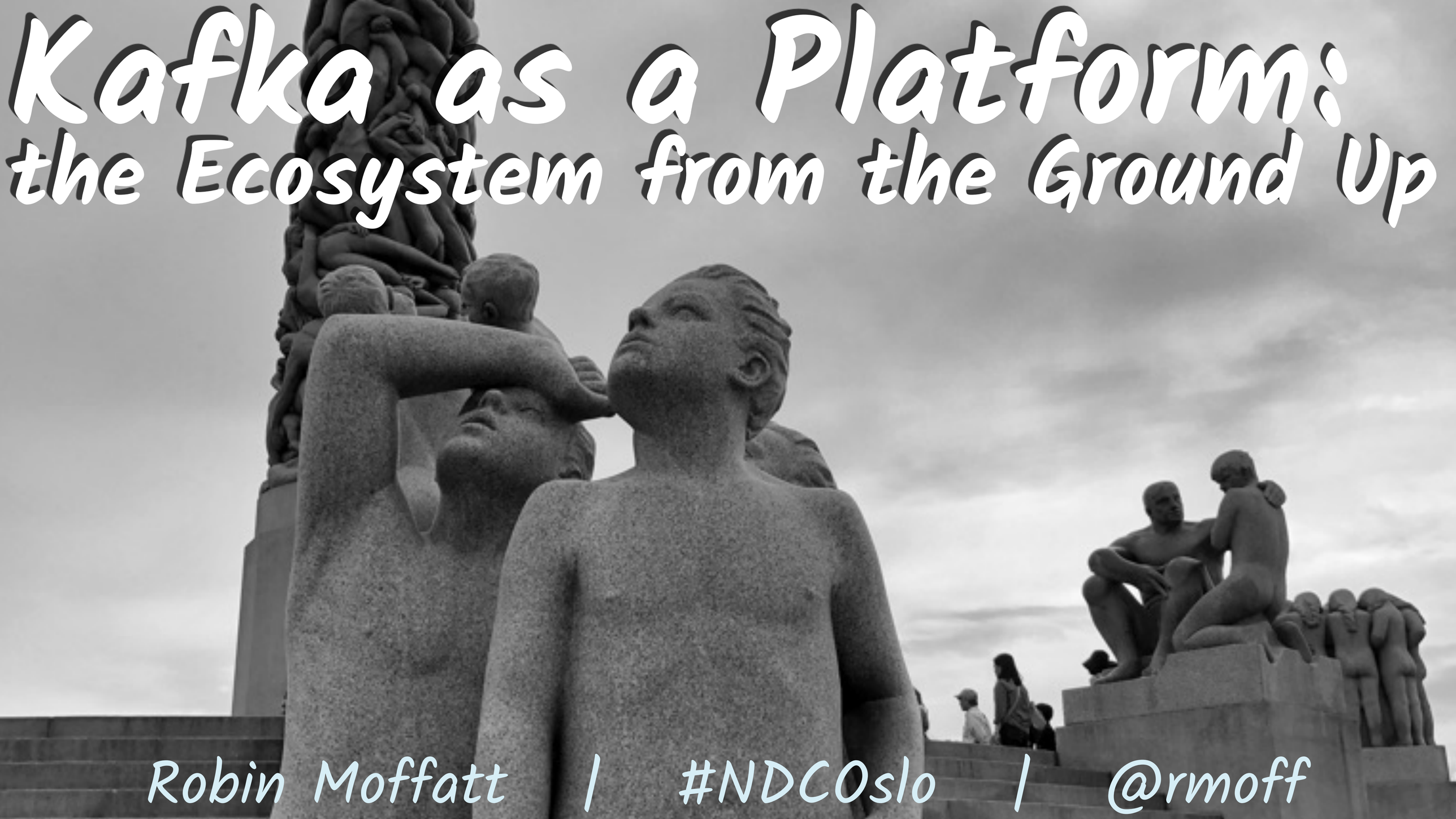
Kafka as a Platform: the Ecosystem from the Ground Up



Robin Moffatt | #NDCOslo | @rmoff

$ whoami

- Robin Moffatt (@rmoff)
- Senior Developer Advocate at Confluent

  (Apache Kafka, not Wikis 😉)

- Working in data & analytics since 2001
- Oracle ACE Director (Alumnus)

http://rmoff.dev/**talks** • http://rmoff.dev/**blog** • http://rmoff.dev/**youtube**

EVENTS

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EVENTS

EVENTS

- Notification
- State change

Human generated events

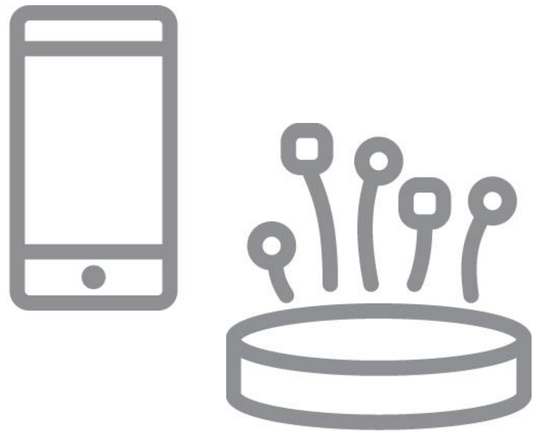
A Sale

A Stock movement

Machine generated events

Networking

IoT



Applications

EVENTS

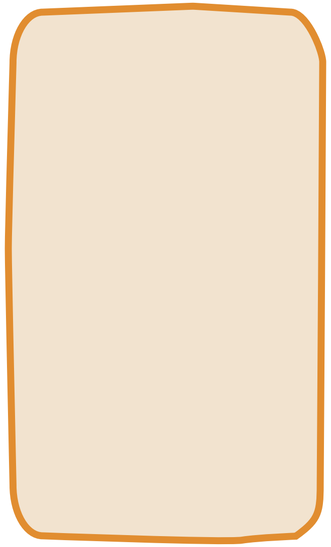
are

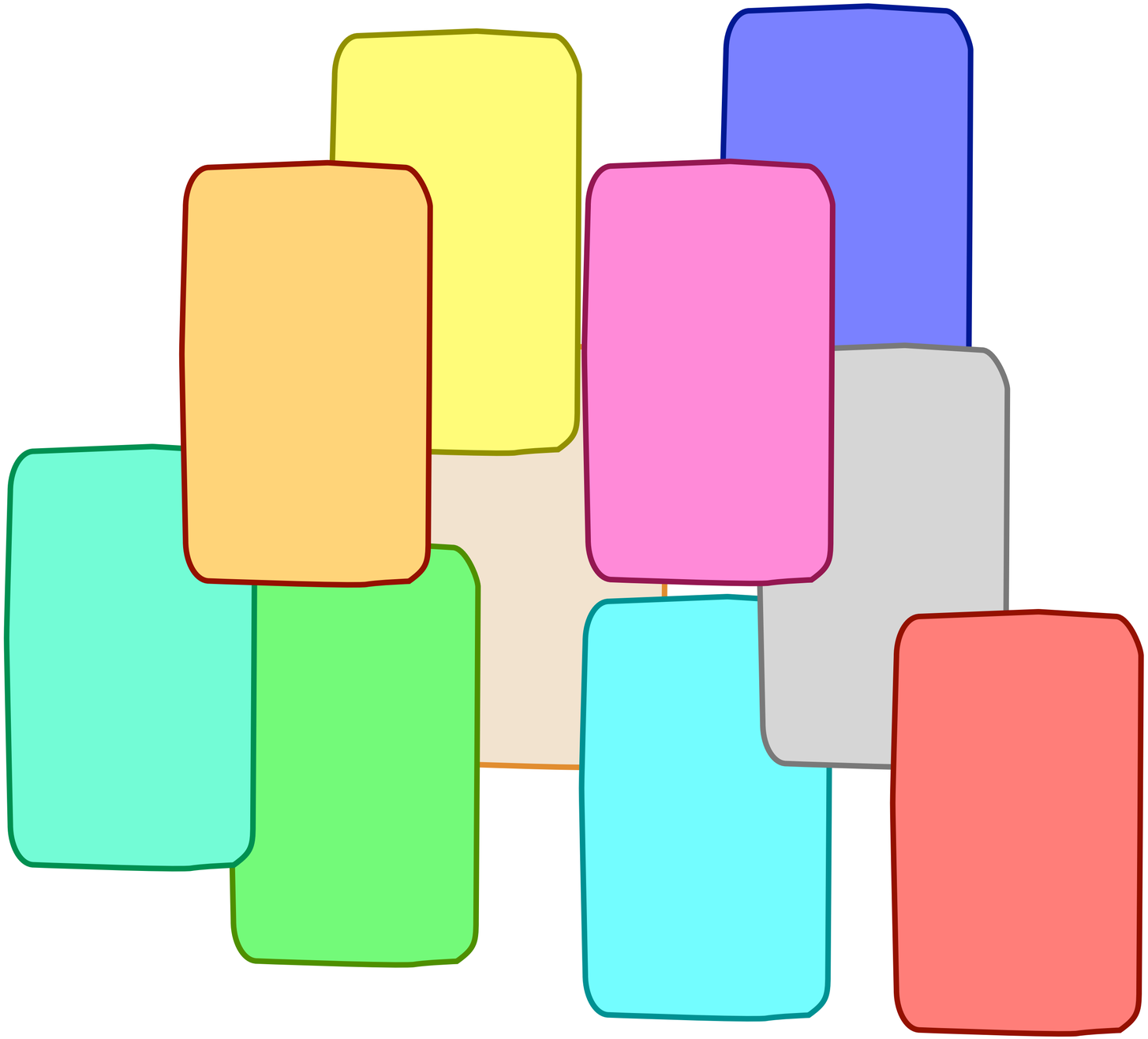
EVERYWHERE

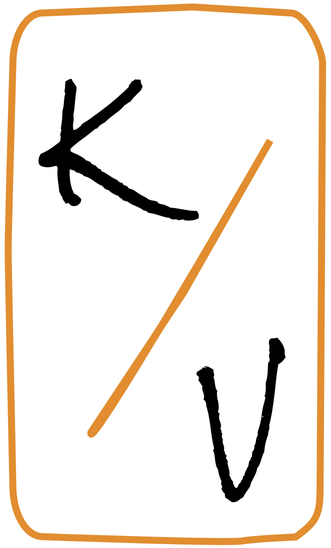
EVENTS

are

very POWERFUL






K
V

LOG

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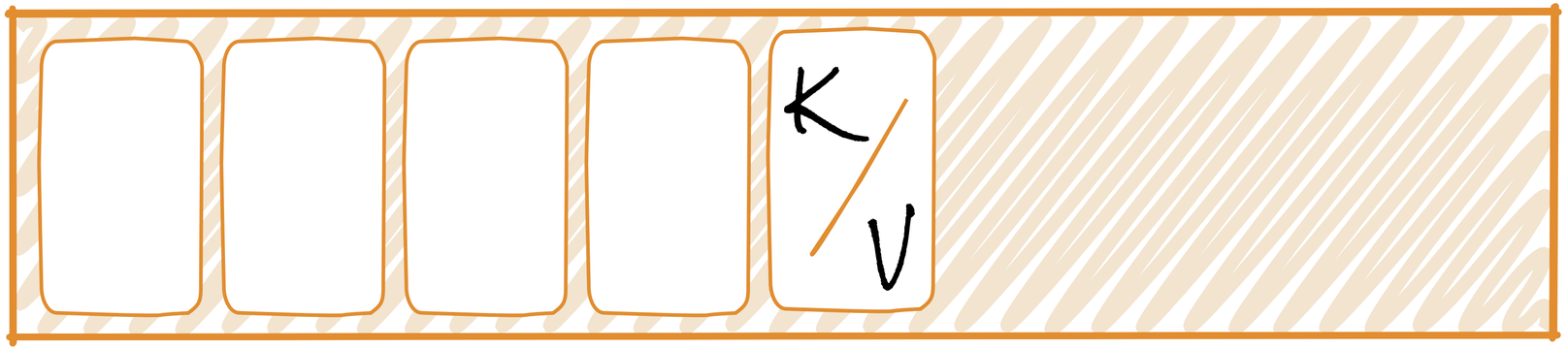
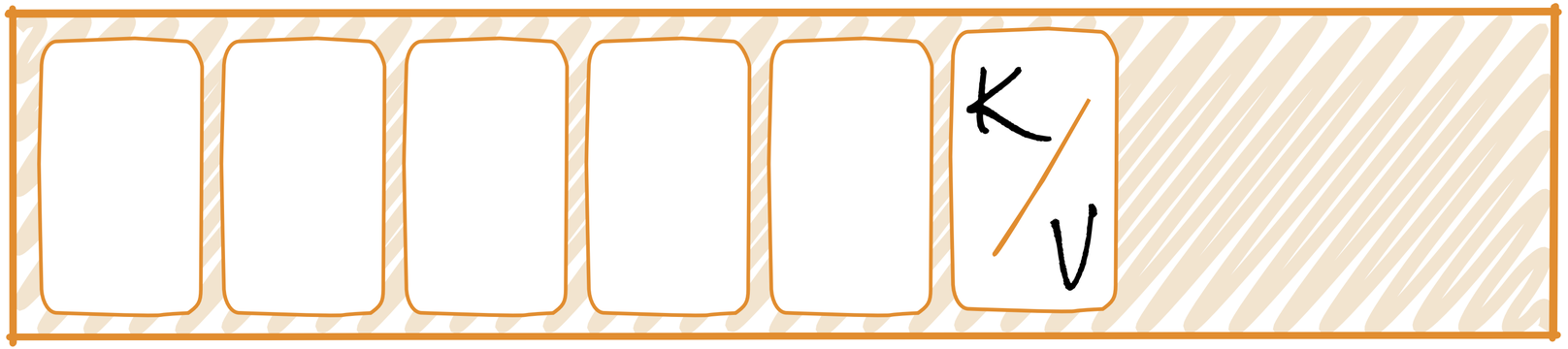
K
V

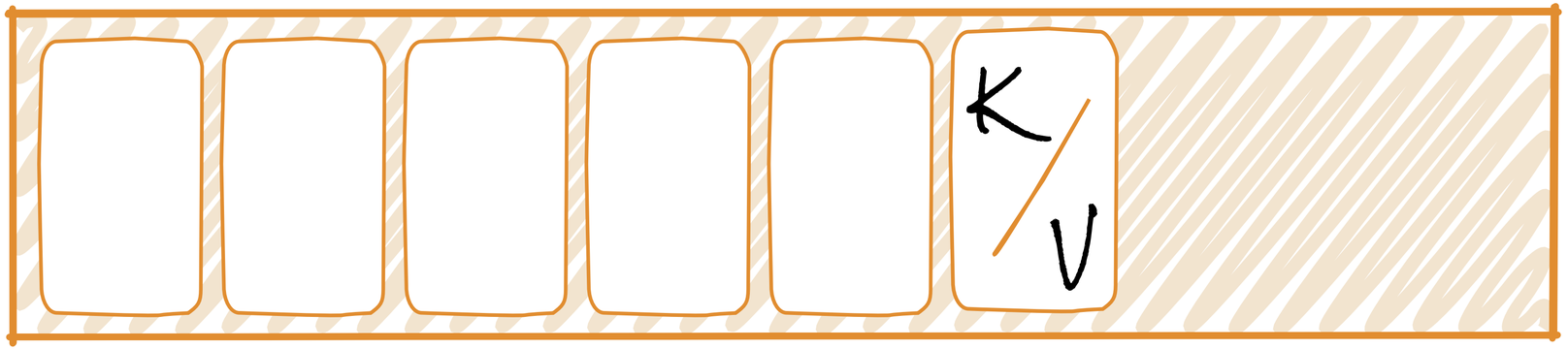
K
V

K
V

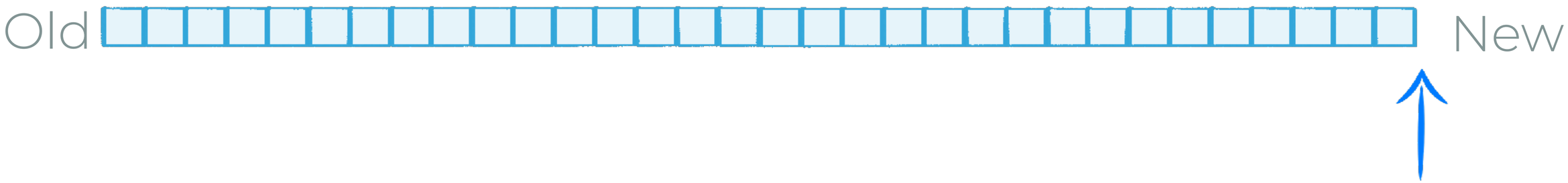
K
V


K
V


K
V


K
V

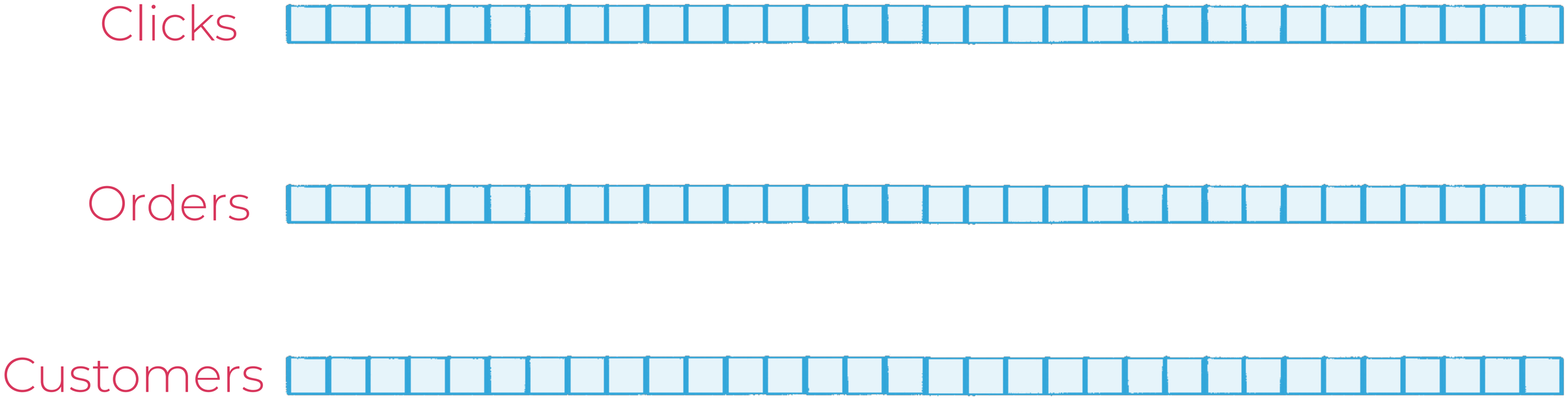
Immutable Event Log



Events are added at the end of the log

TOPICS

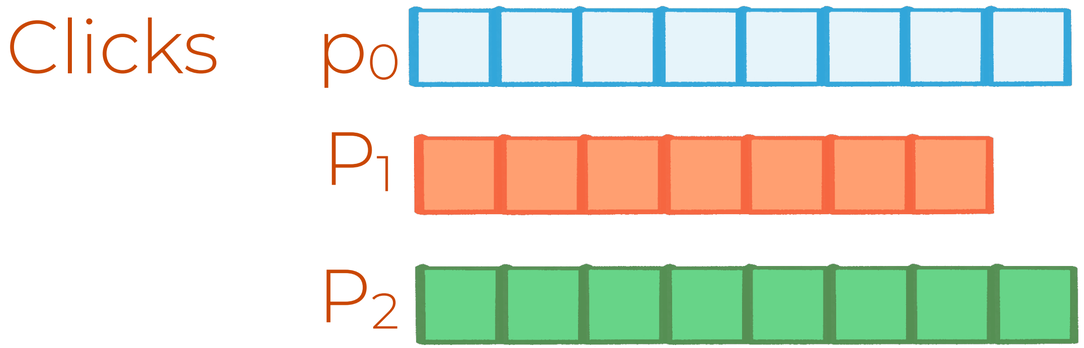
Topics



Topics are similar in concept to tables in a database

PARTITIONS

Partitions



Messages are guaranteed to be strictly ordered within a partition

PUB / SUB

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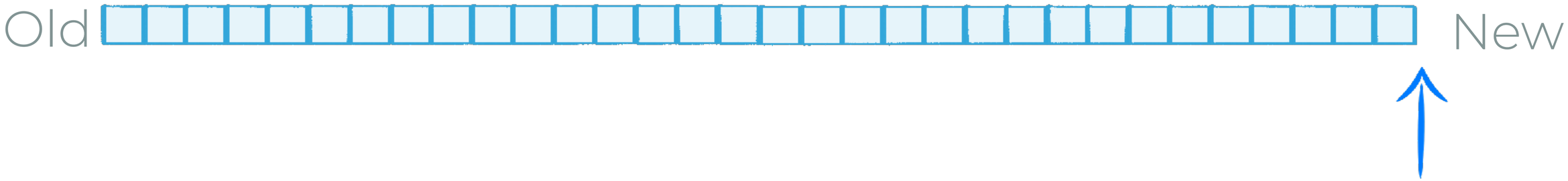
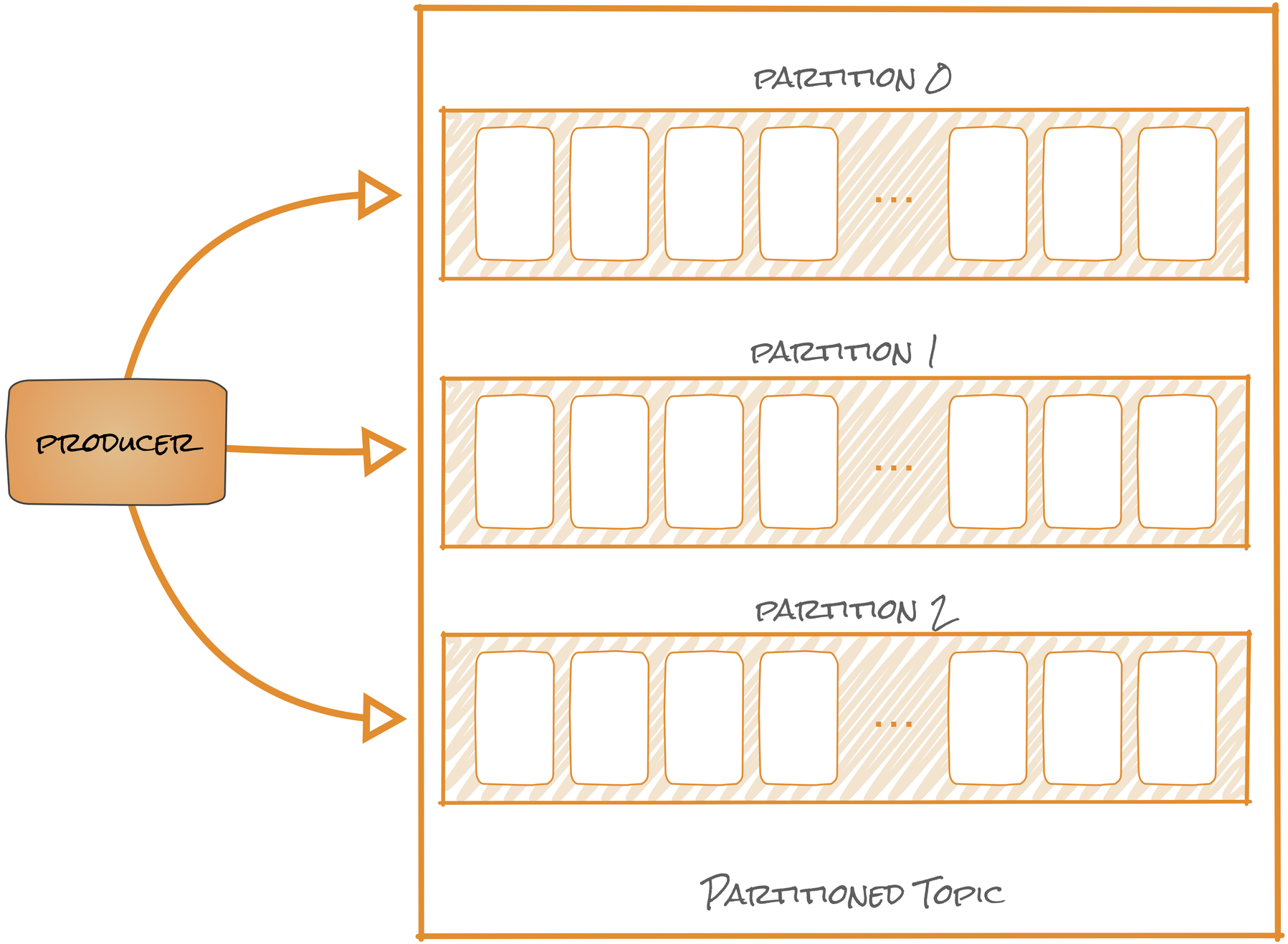
PUB / SUB

Producing data



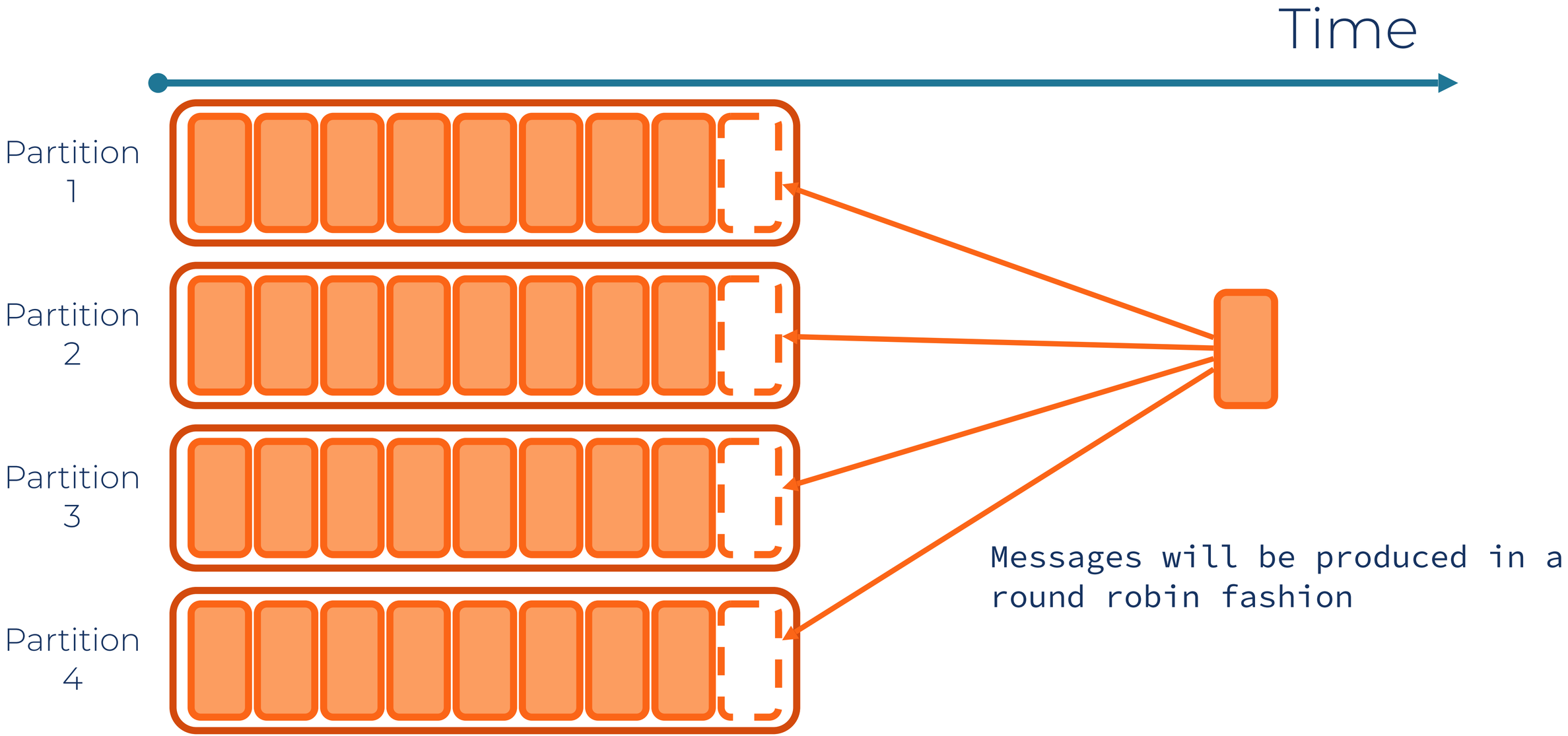
Messages are added at the end of the log


PRODUCER
PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC

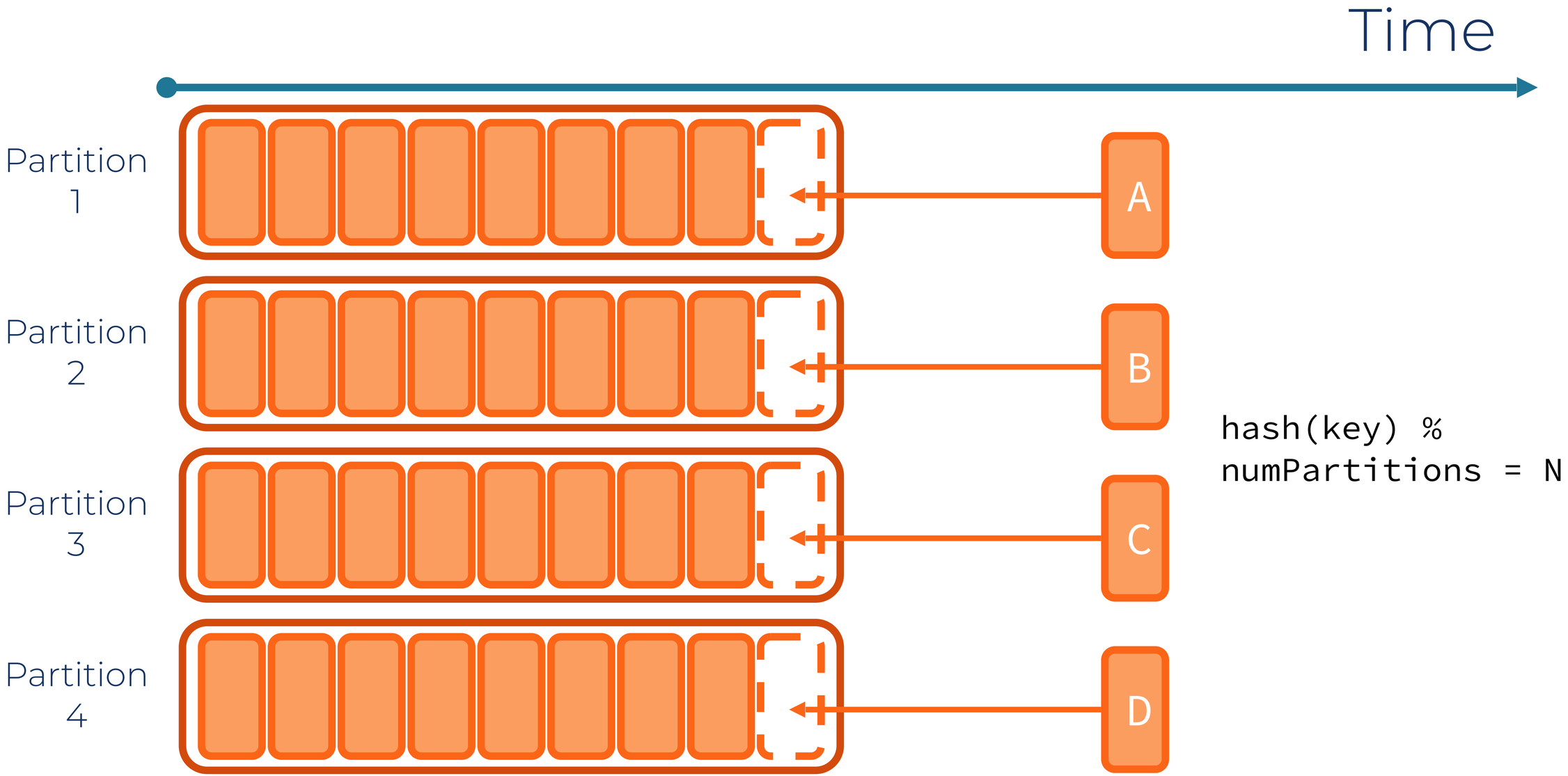
```
try (KafkaProducer<String, Payment> producer = new KafkaProducer<String, Payment>(props)) {

    for (long i = 0; i < 10; i++) {
        final String orderId = "id" + Long.toString(i);
        final Payment payment = new Payment(orderId, 1000.00d);
        final ProducerRecord<String, Payment> record =
           new ProducerRecord<String, Payment>("transactions",
                                               payment.getId().toString(),
                                               payment);
        producer.send(record);
    }
} catch (final InterruptedException e) {
    e.printStackTrace();
}
```

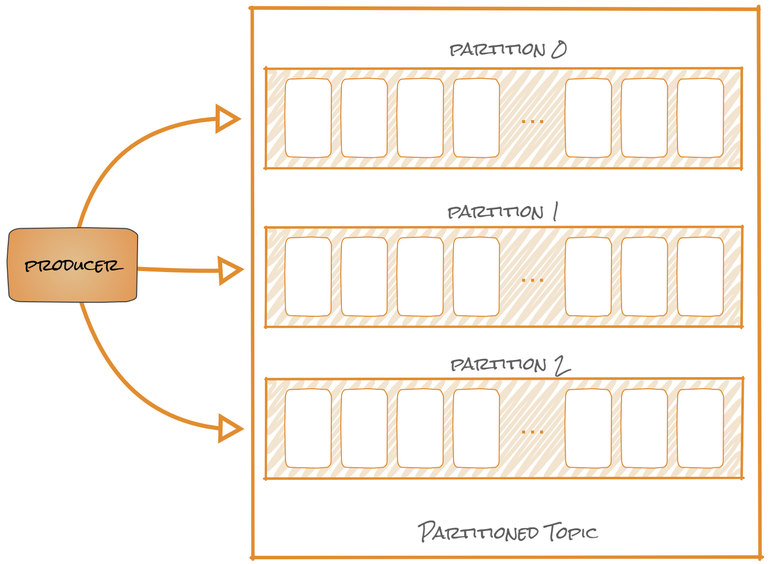
Producing to Kafka - No Key



Producing to Kafka - With Key



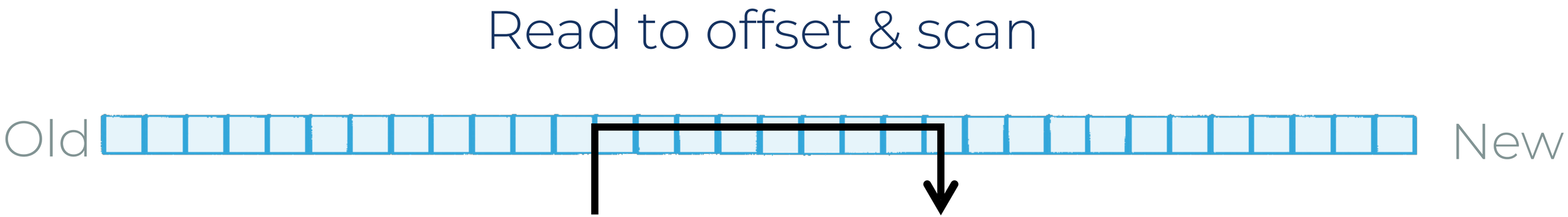
Producers



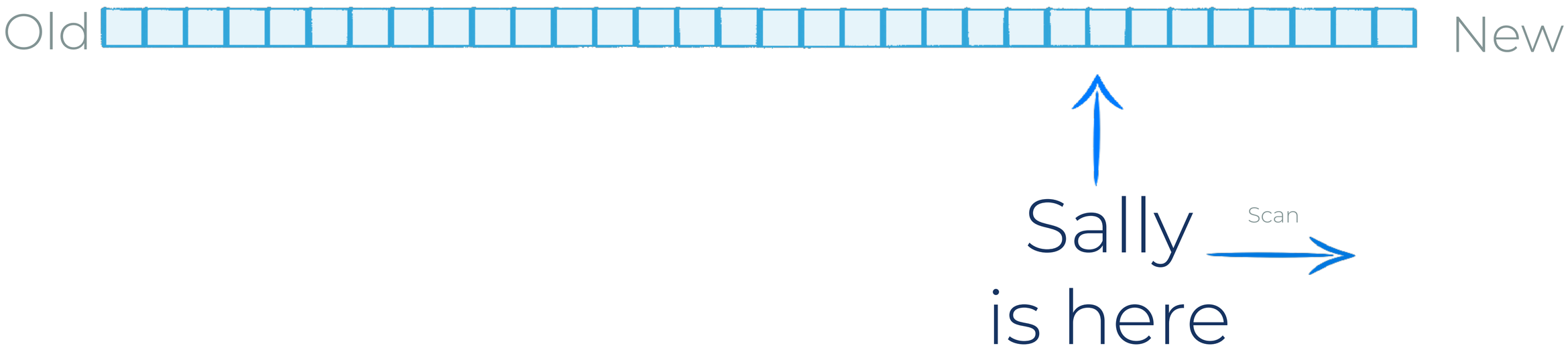
- A client application
- Puts messages into topics
- Handles partitioning, network protocol
- Java, Go, .NET, C/C++, Python
- Also every other language

PUB / SUB

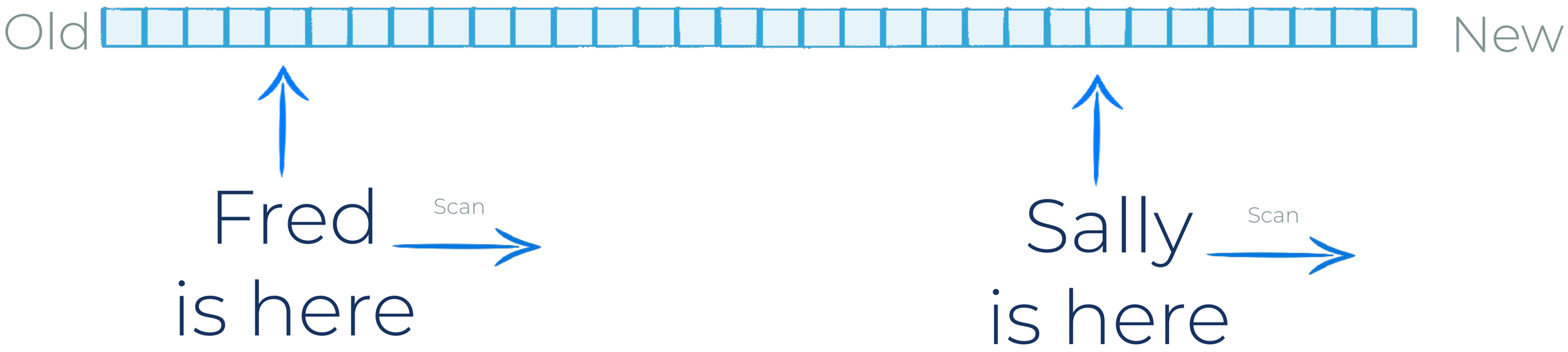
Consuming data - access is only sequential



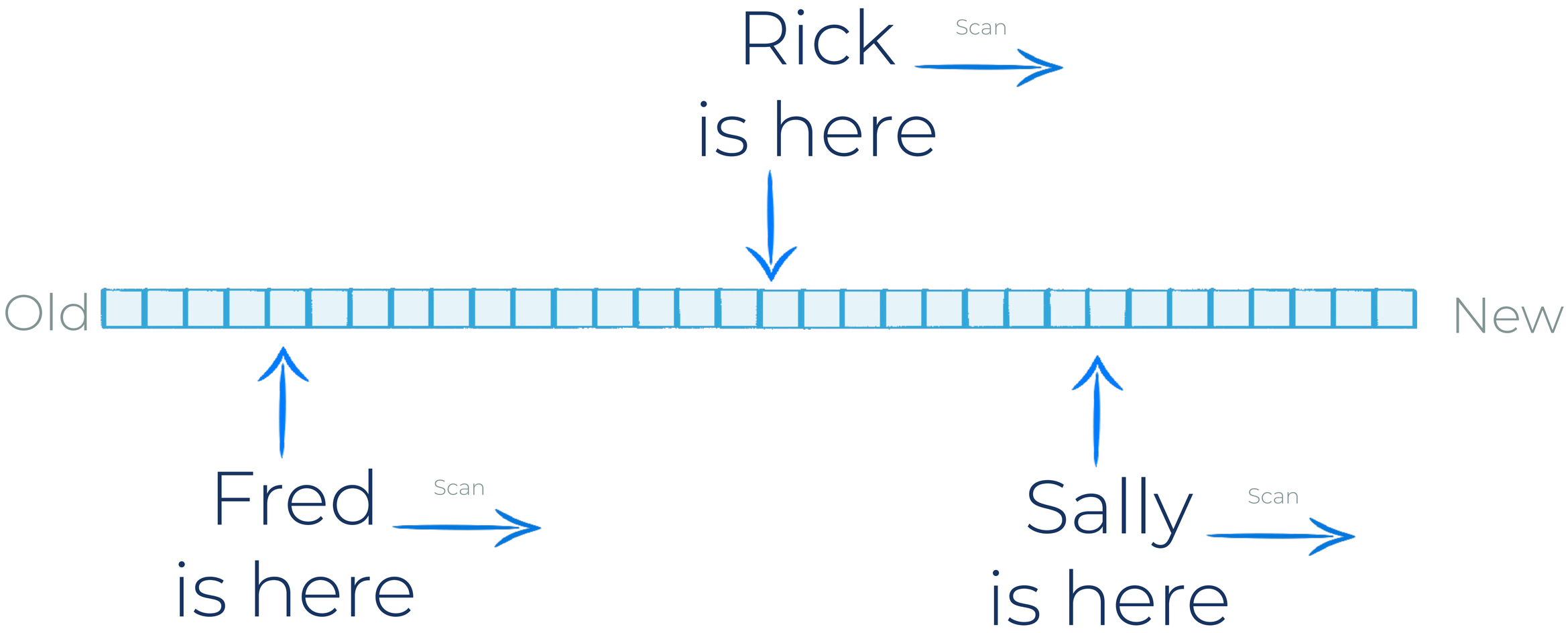
Consumers have a position of their own



Consumers have a position of their own

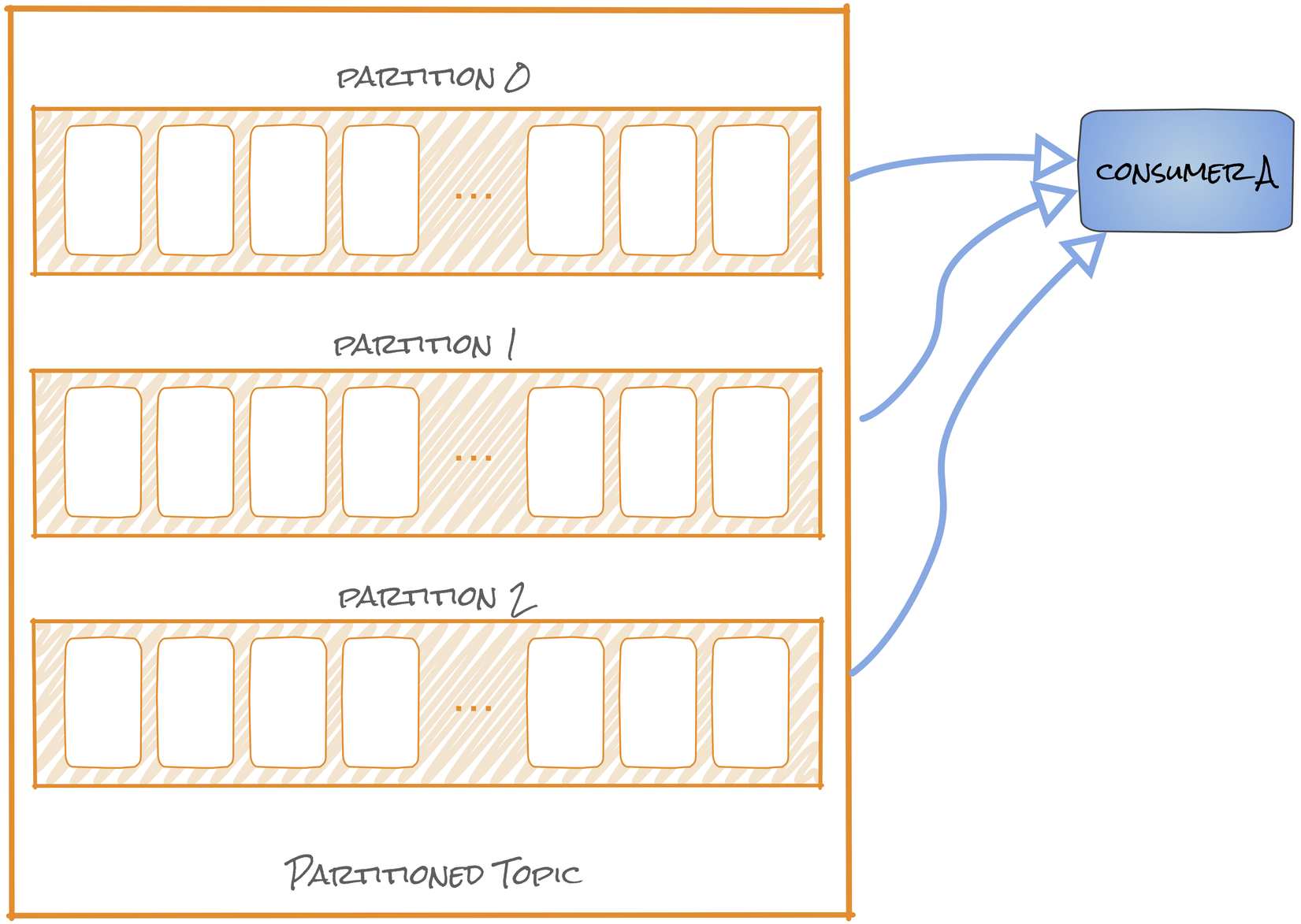


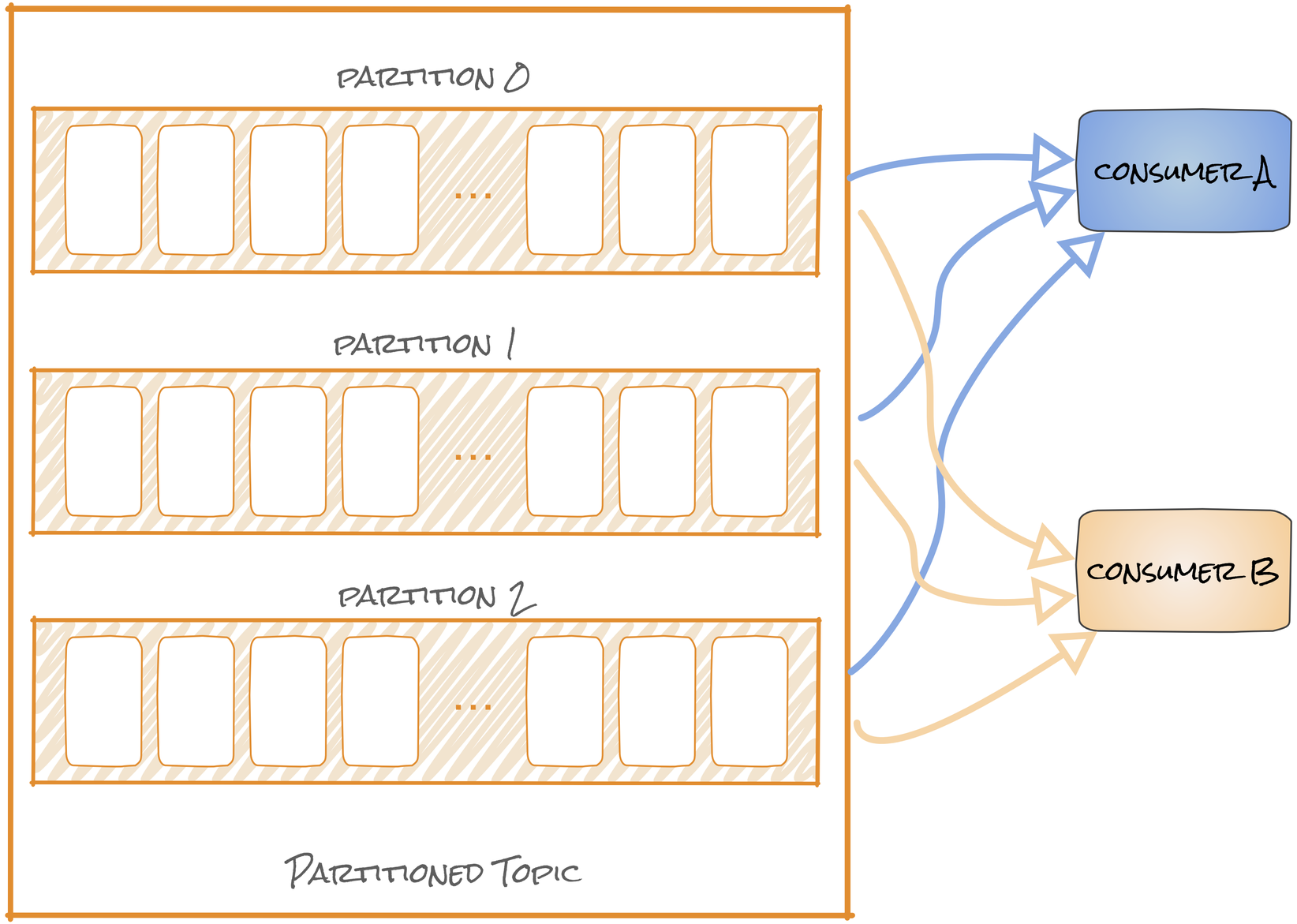
Consumers have a position of their own



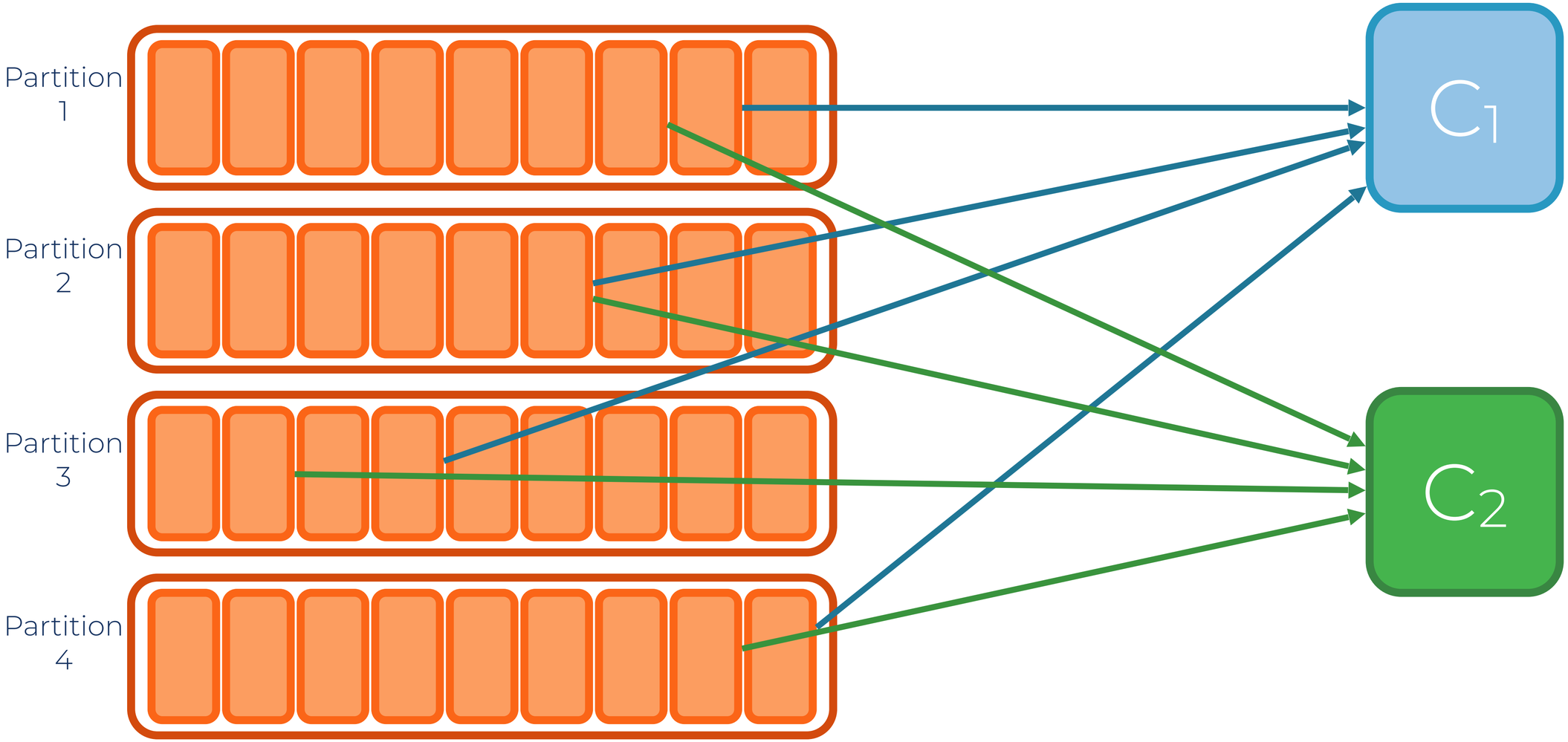
```
try (final KafkaConsumer<String, Payment> consumer = new KafkaConsumer<>(props)) {
    consumer.subscribe(Collections.singletonList(TOPIC));

    while (true) {
        ConsumerRecords<String, Payment> records = consumer.poll(100);
        for (ConsumerRecord<String, Payment> record : records) {
            String key = record.key();
            Payment value = record.value();
            System.out.printf("key = %s, value = %s%n", key, value);
        }
    }
}
```

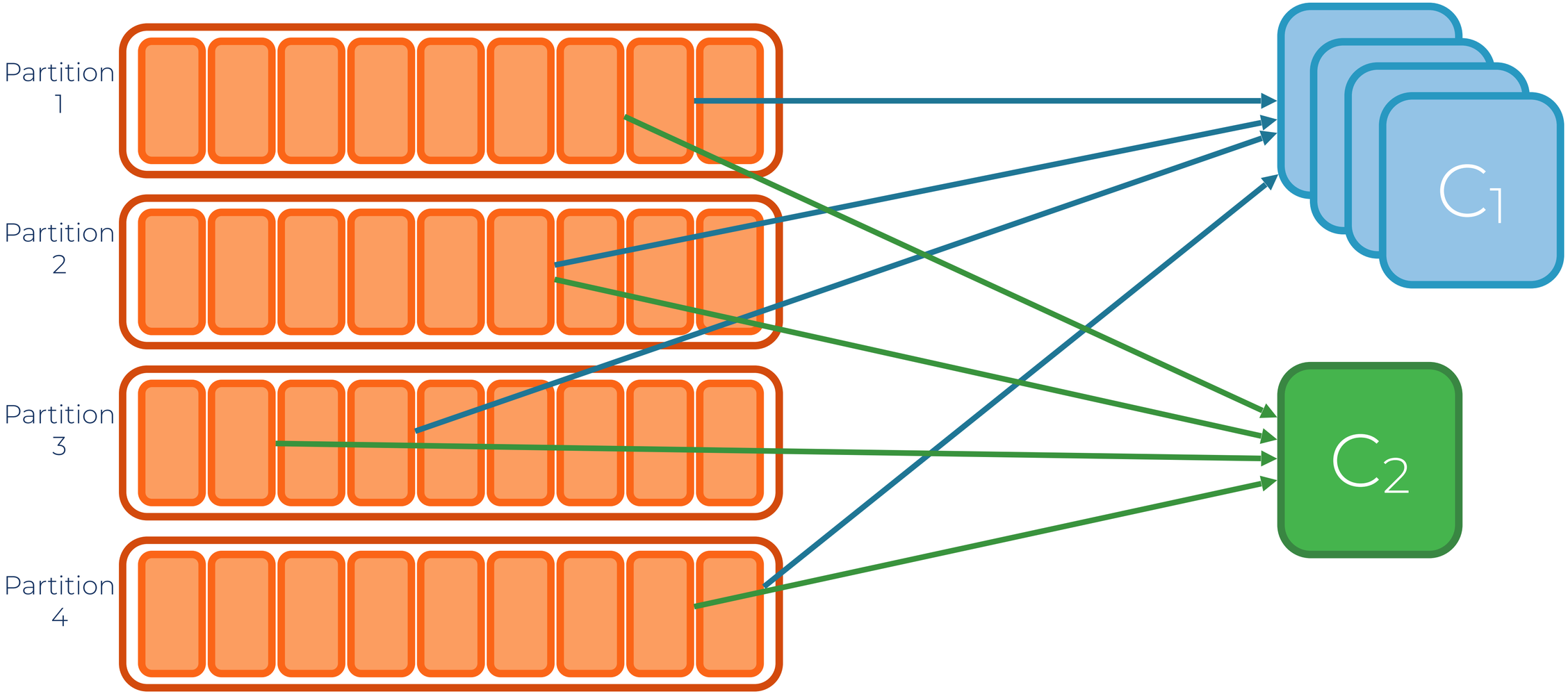

PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A


PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A
CONSUMER B

Consuming From Kafka - Multiple Consumers

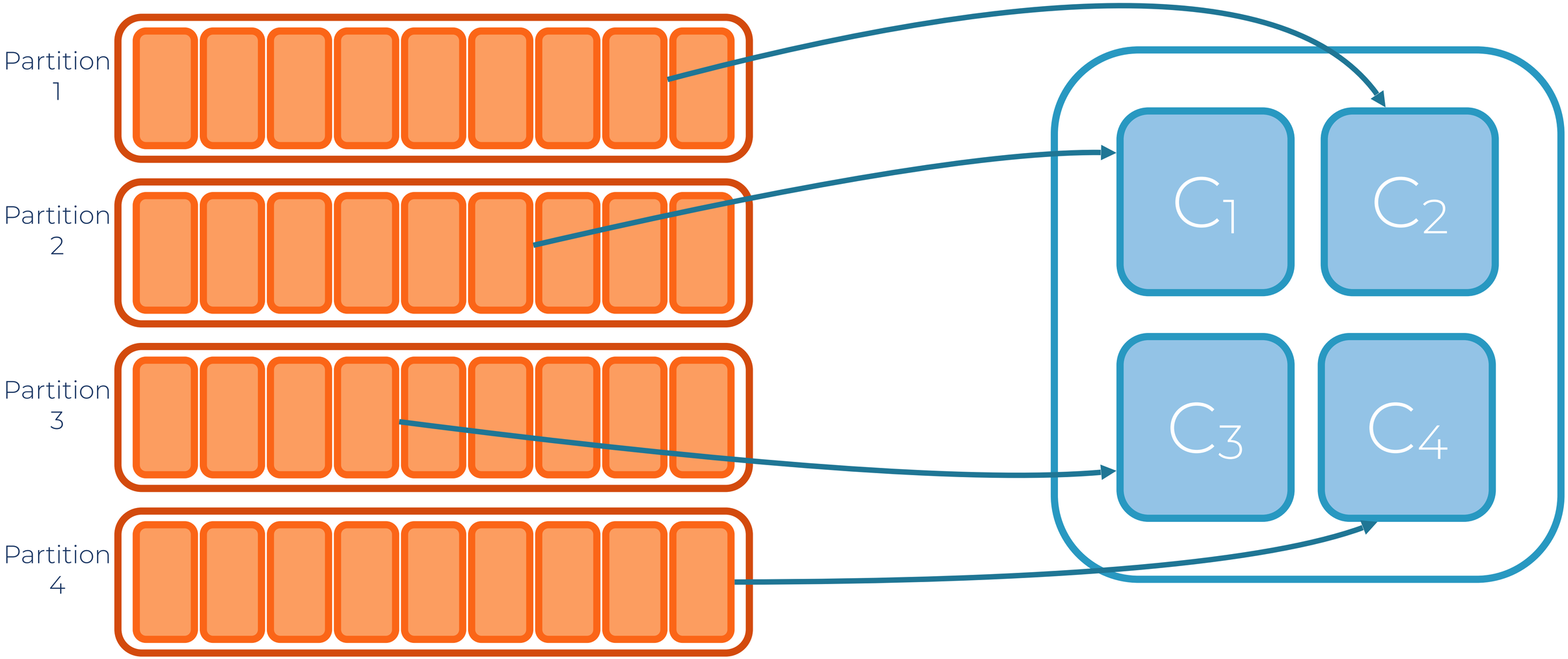


Consuming From Kafka - Grouped Consumers

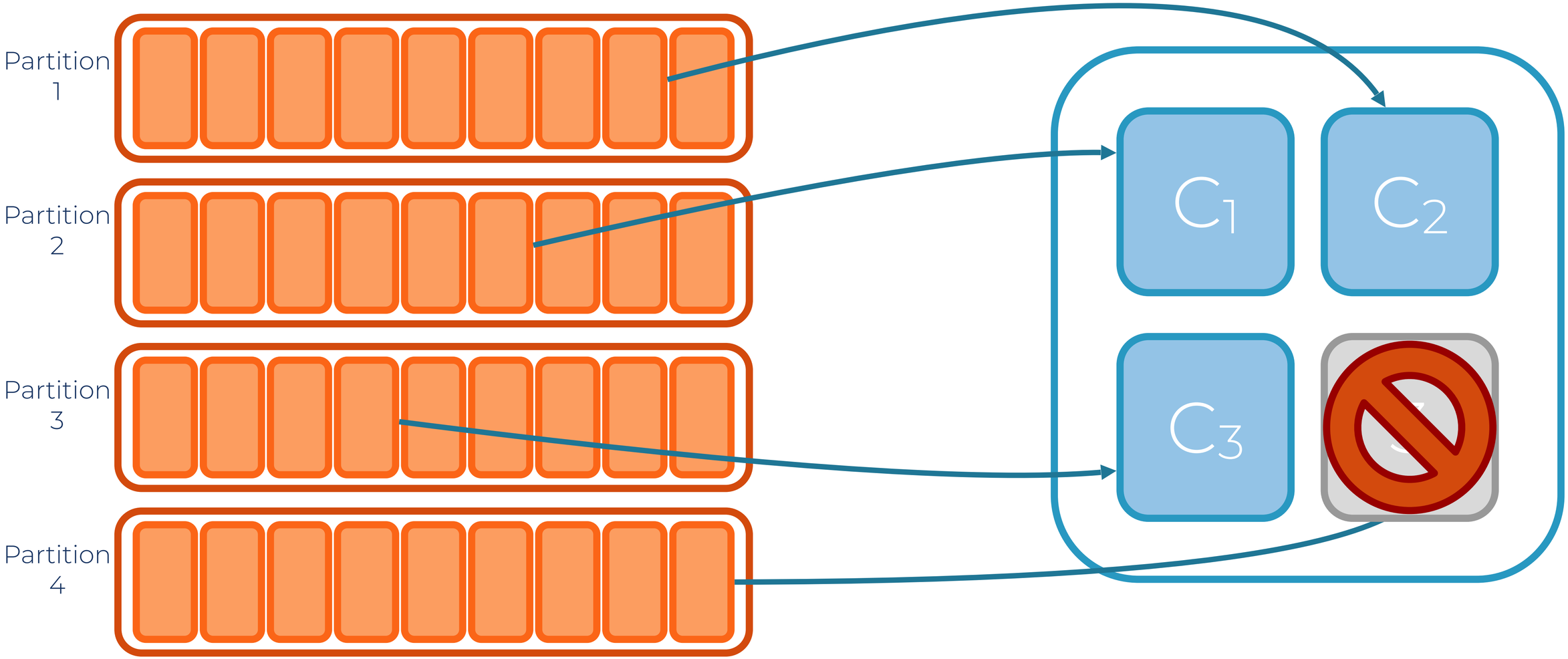


CONSUMER GROUP
COORDINATOR
CONSUMERS
CONSUMER GROUP

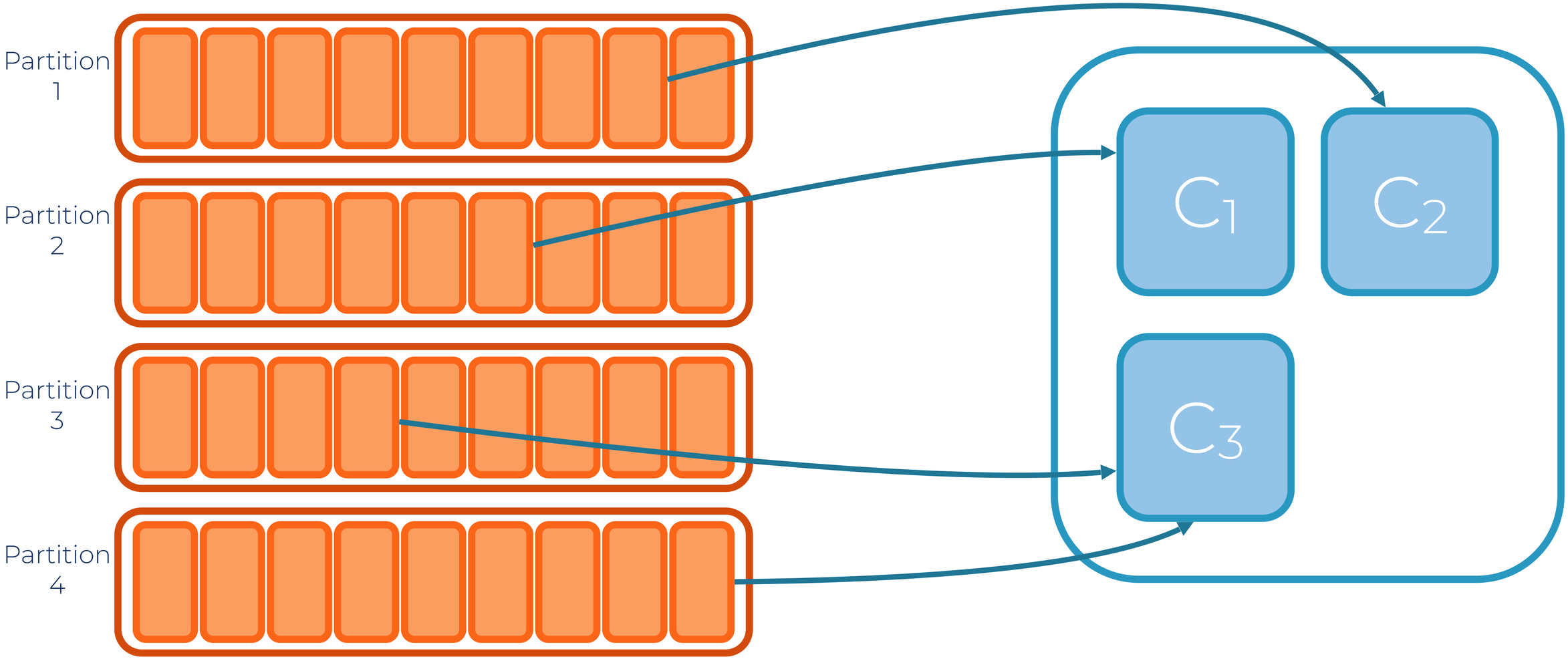
Consuming From Kafka - Grouped Consumers



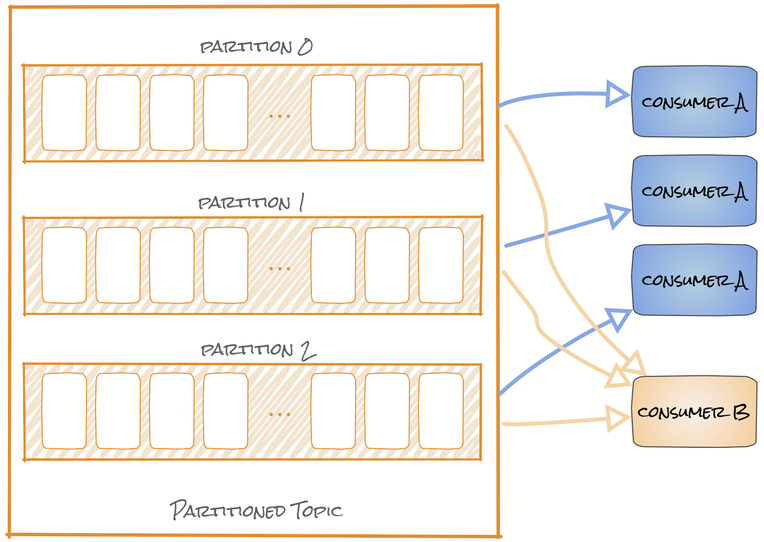
Consuming From Kafka - Grouped Consumers



Consuming From Kafka - Grouped Consumers



Consumers



- A client application
- Reads messages from topics
- Horizontally, elastically scalable (if stateless)
- Java, Go, .NET, C/C++, Python, everything else

BROKERS

and REPLICATION

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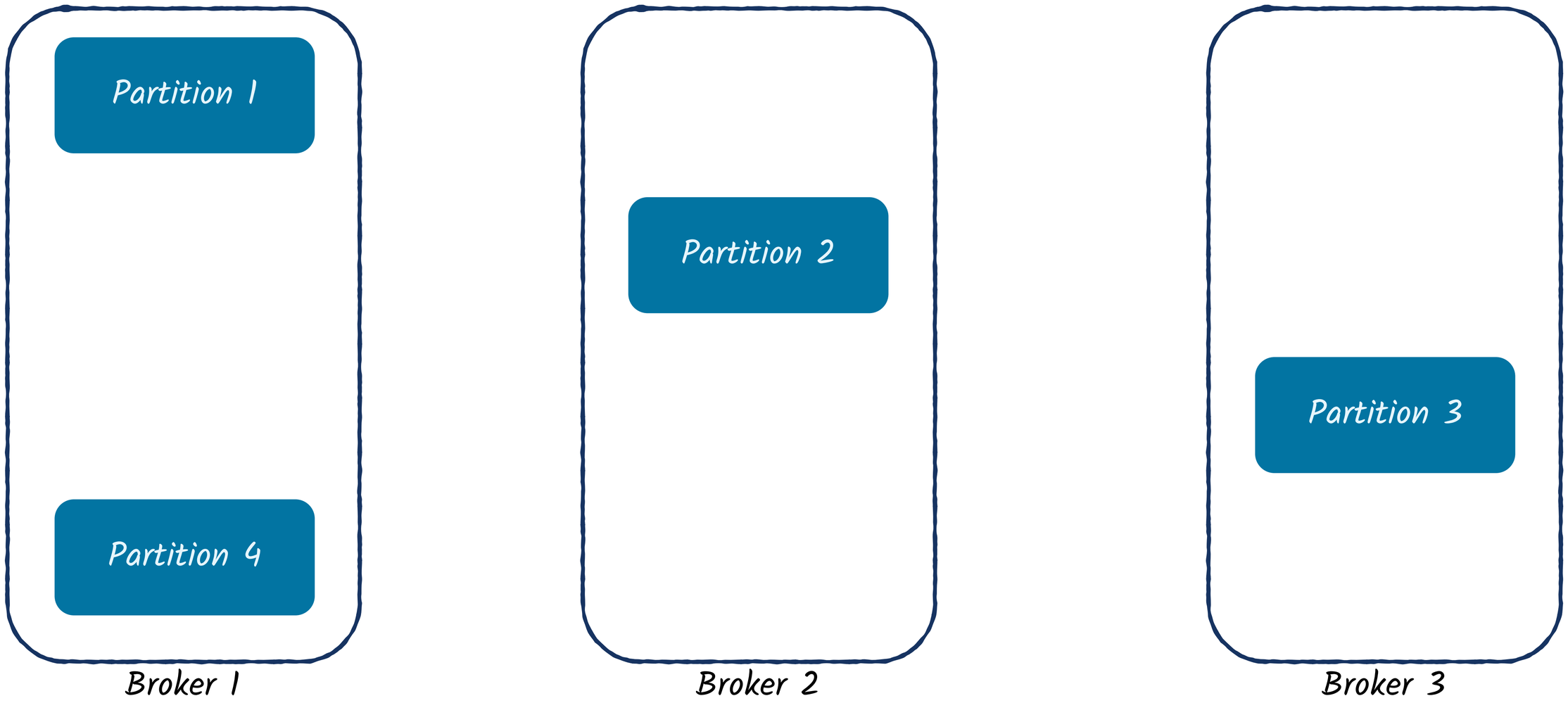
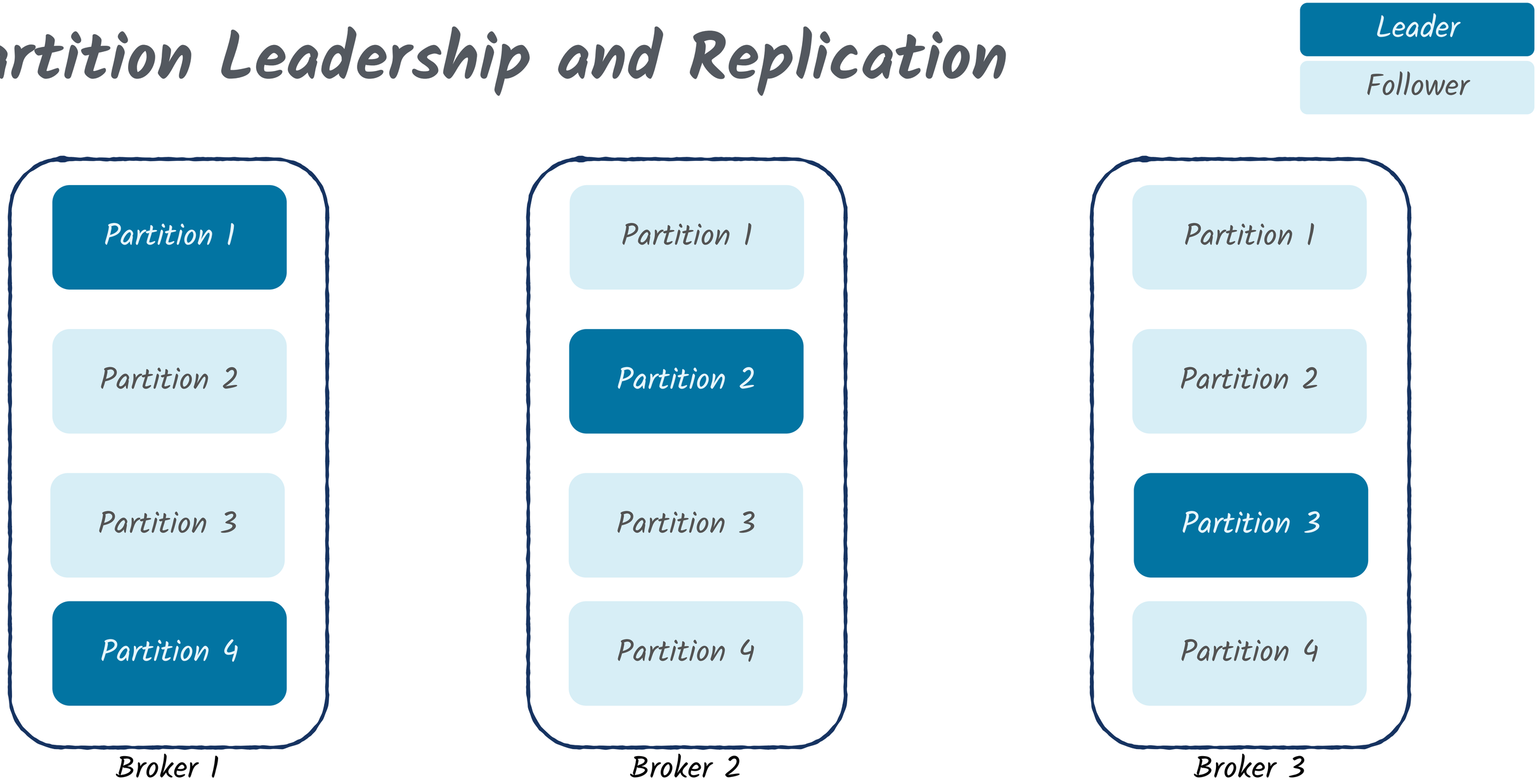
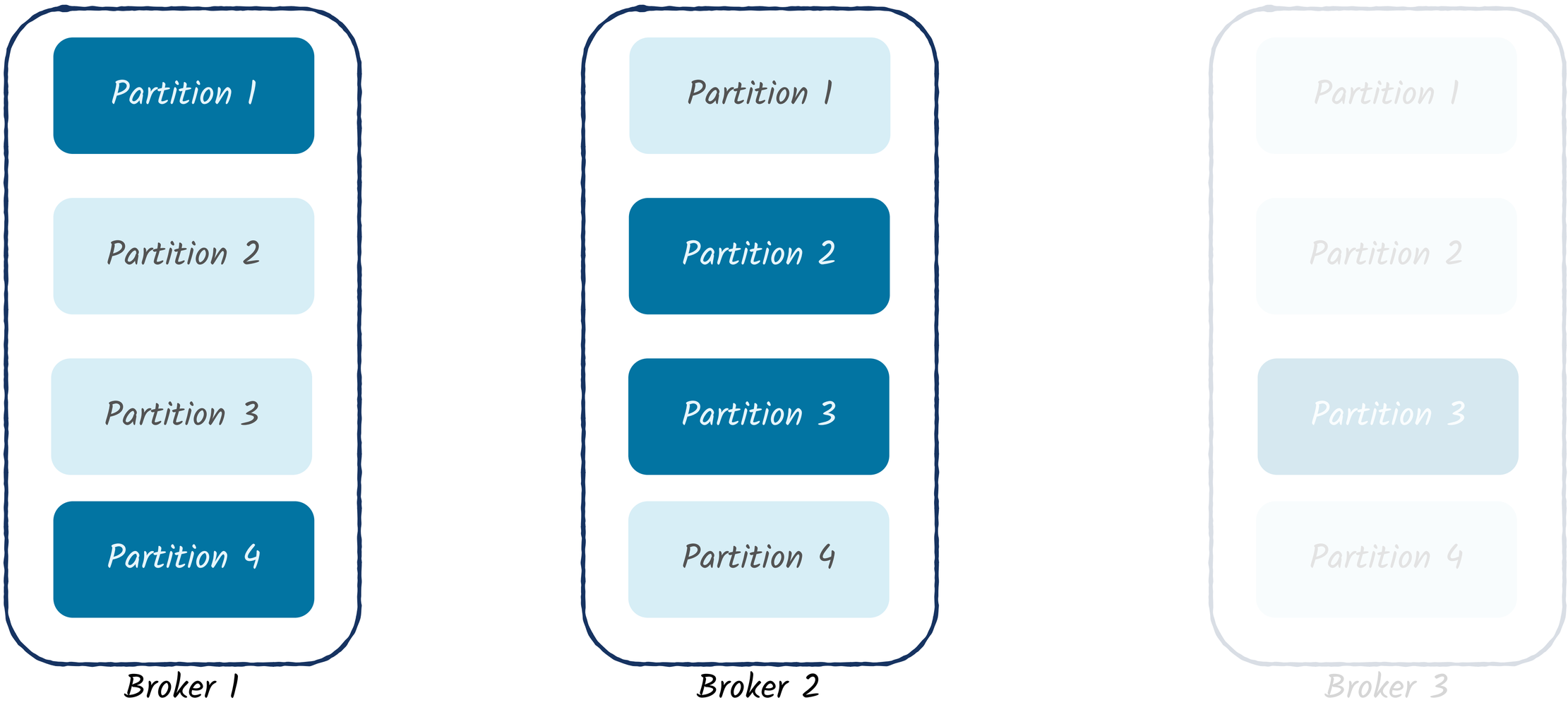
Partition Leadership and Replication



Partition Leadership and Replication



Partition Leadership and Replication



CONFLUENT

DEMO

So far, this is

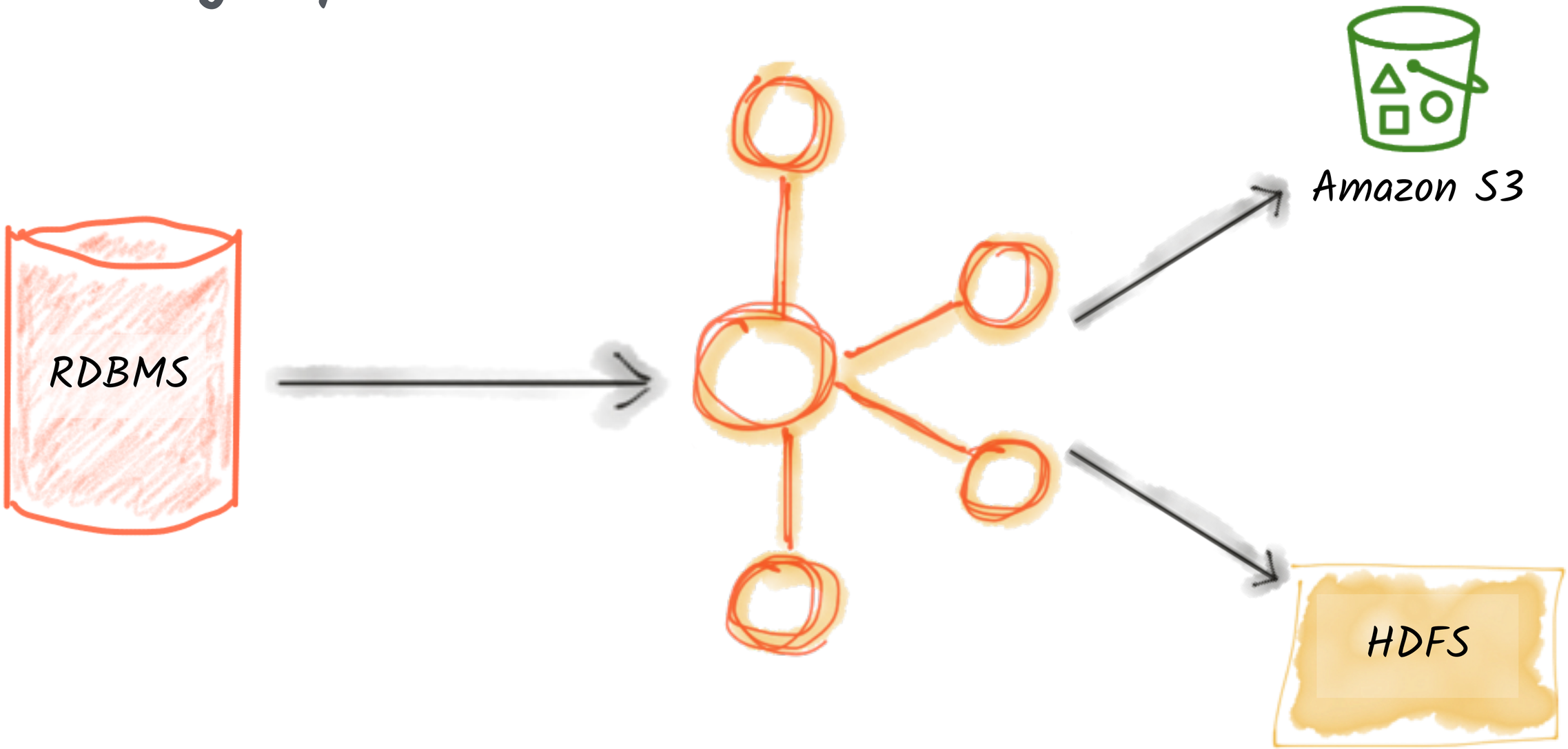
Pretty good

So far, this is

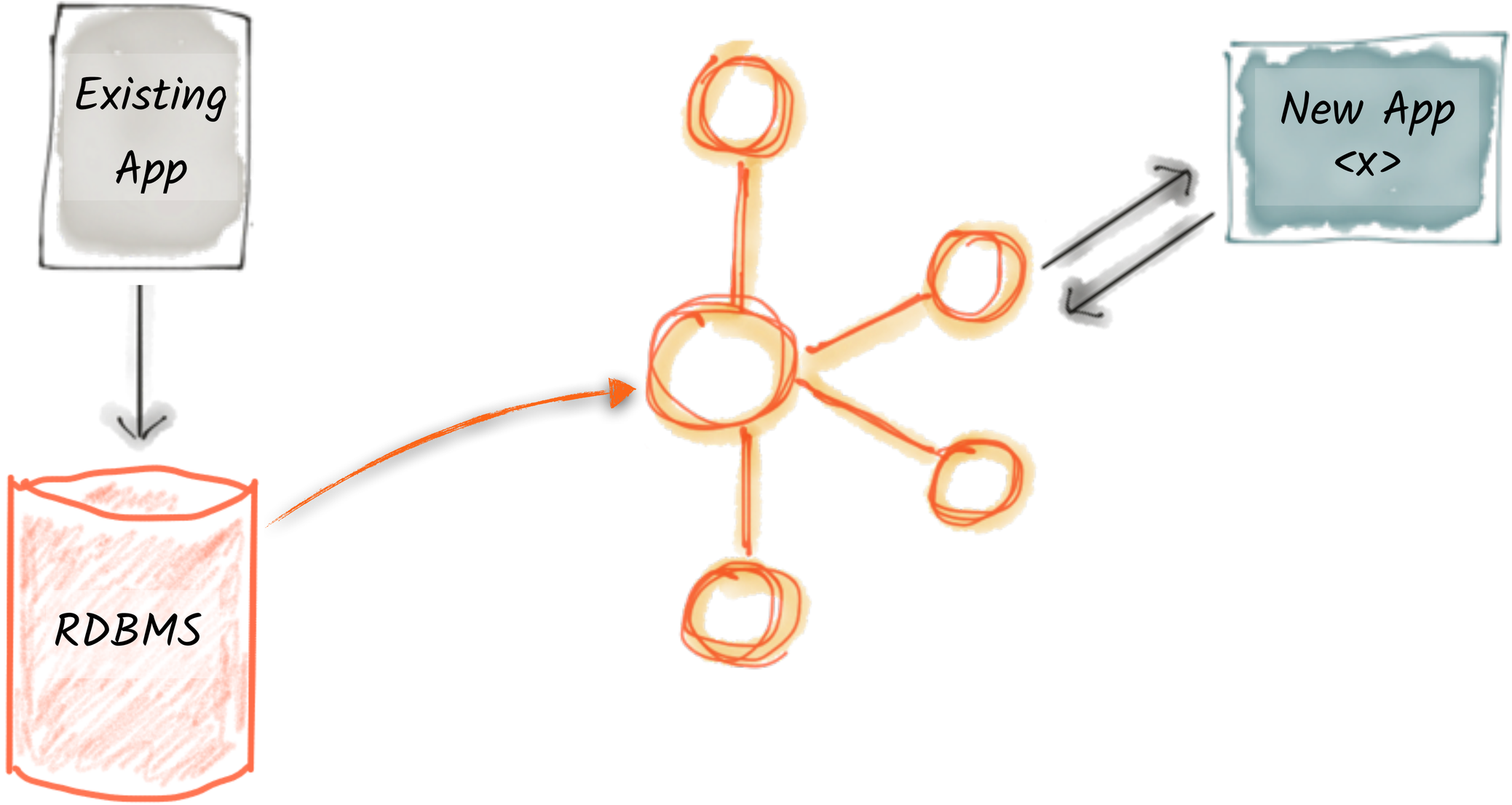
Pretty good

but I've not finished yet...

Streaming Pipelines

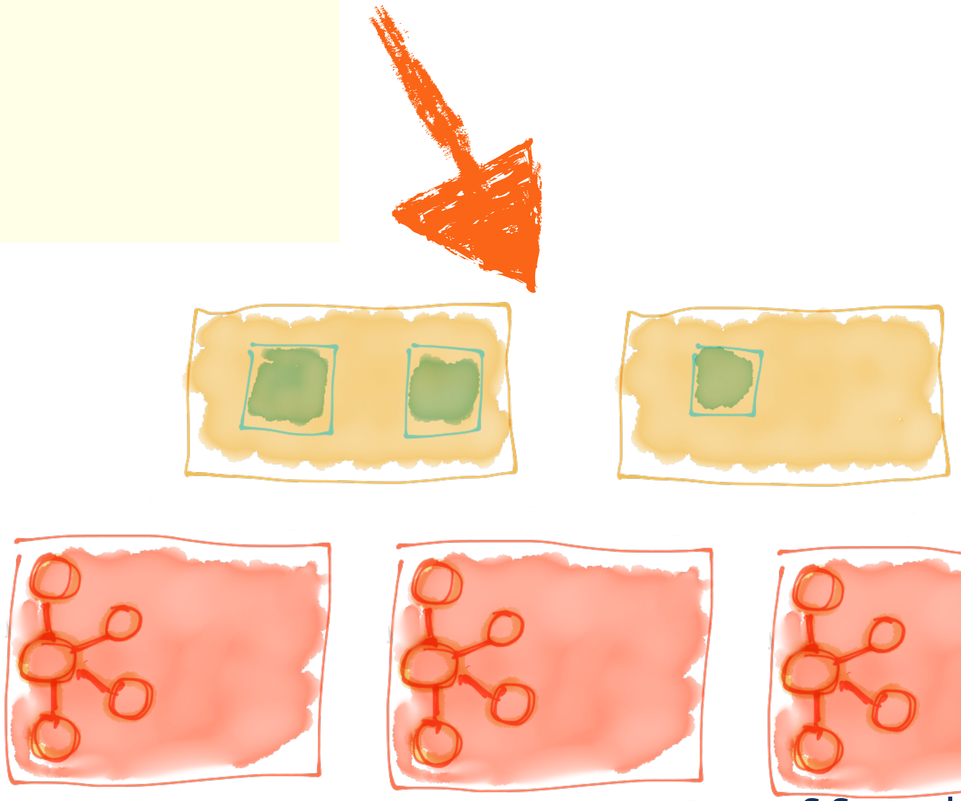


Evolve processing from old systems to new



Streaming Integration with Kafka Connect

Sources

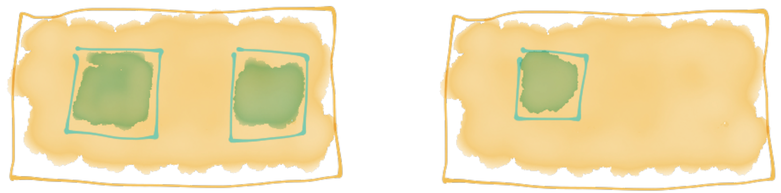


Kafka Connect

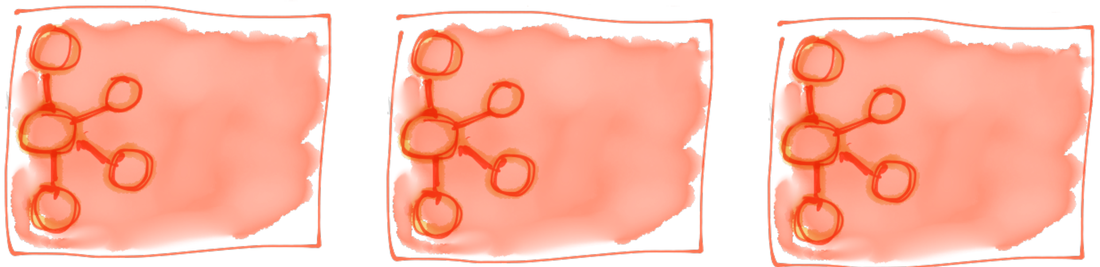
Kafka Brokers

Streaming Integration with Kafka Connect

Sinks



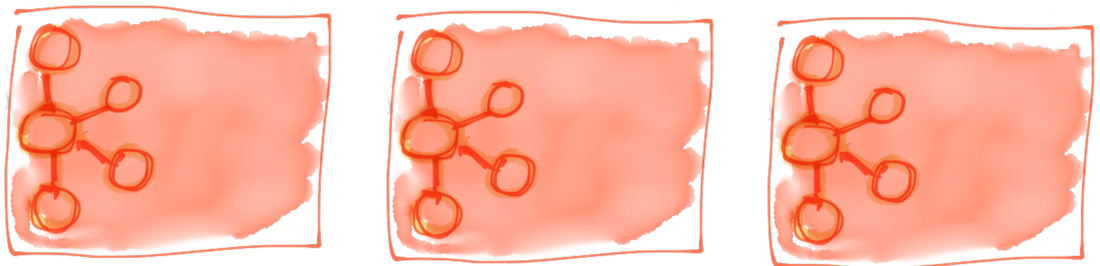
Kafka Connect



Kafka Brokers

Streaming Integration with Kafka Connect

Kafka Connect



Kafka Brokers

Look Ma, No Code!

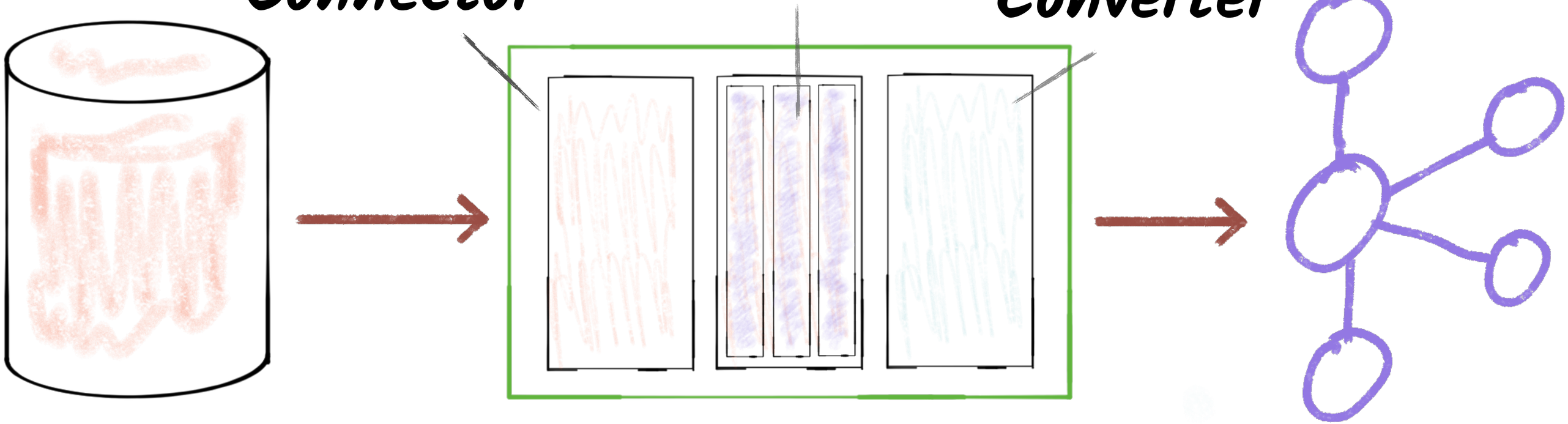
```
{
  "connector.class":
    "io.confluent.connect.jdbc.JdbcSourceConnector",
  "connection.url":
    "jdbc:mysql://asgard:3306/demo",
  "table.whitelist":
    "sales,orders,customers"
}
```

Extensible

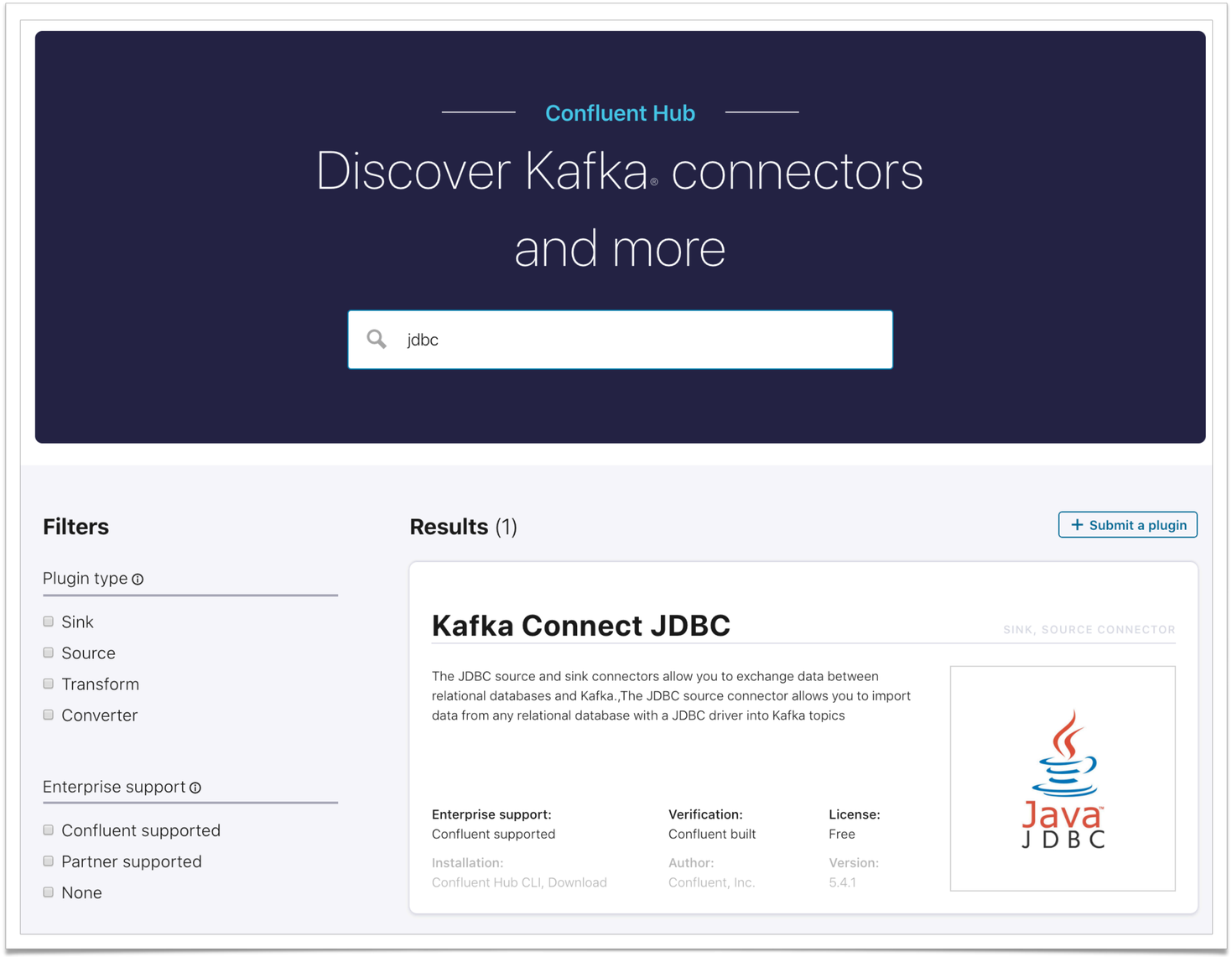
Connector

Transform(s)

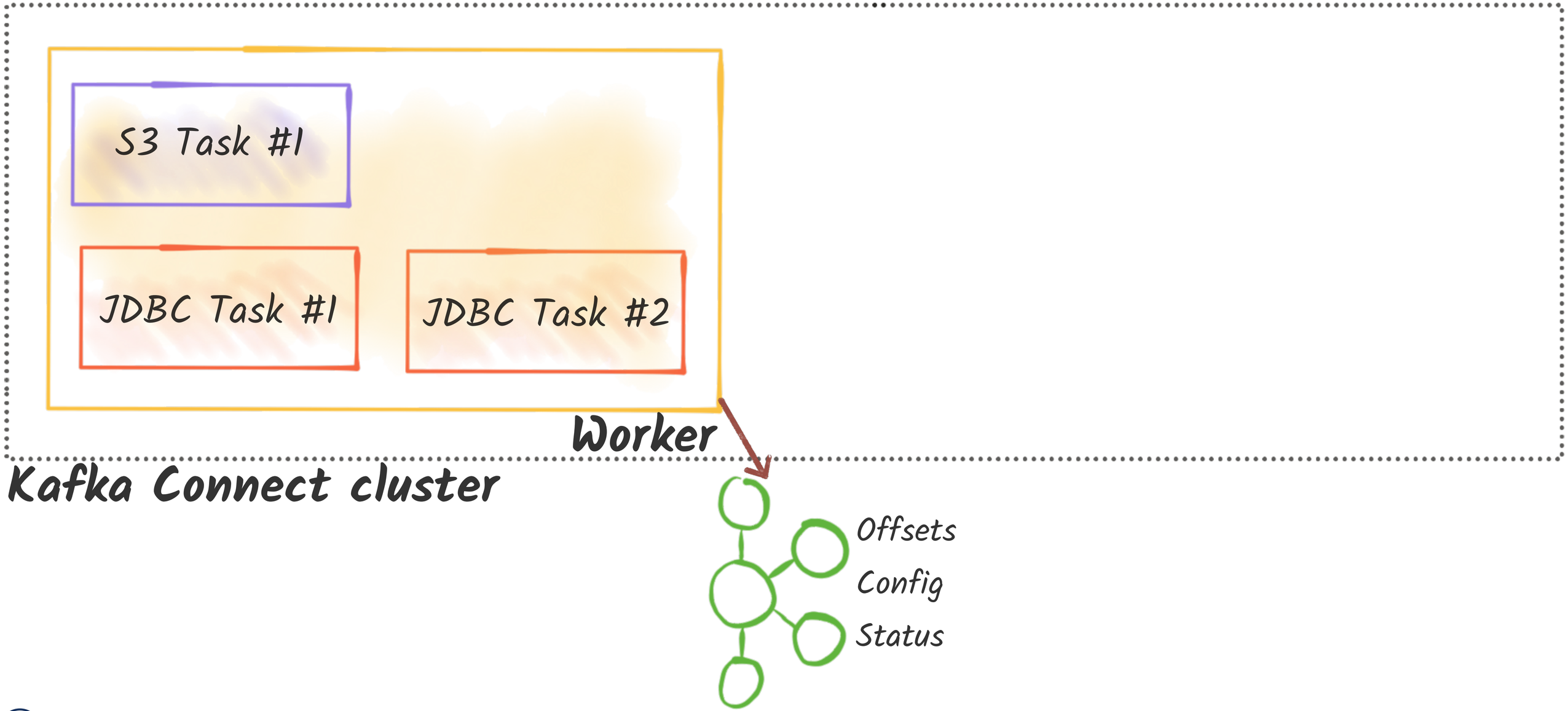
Converter



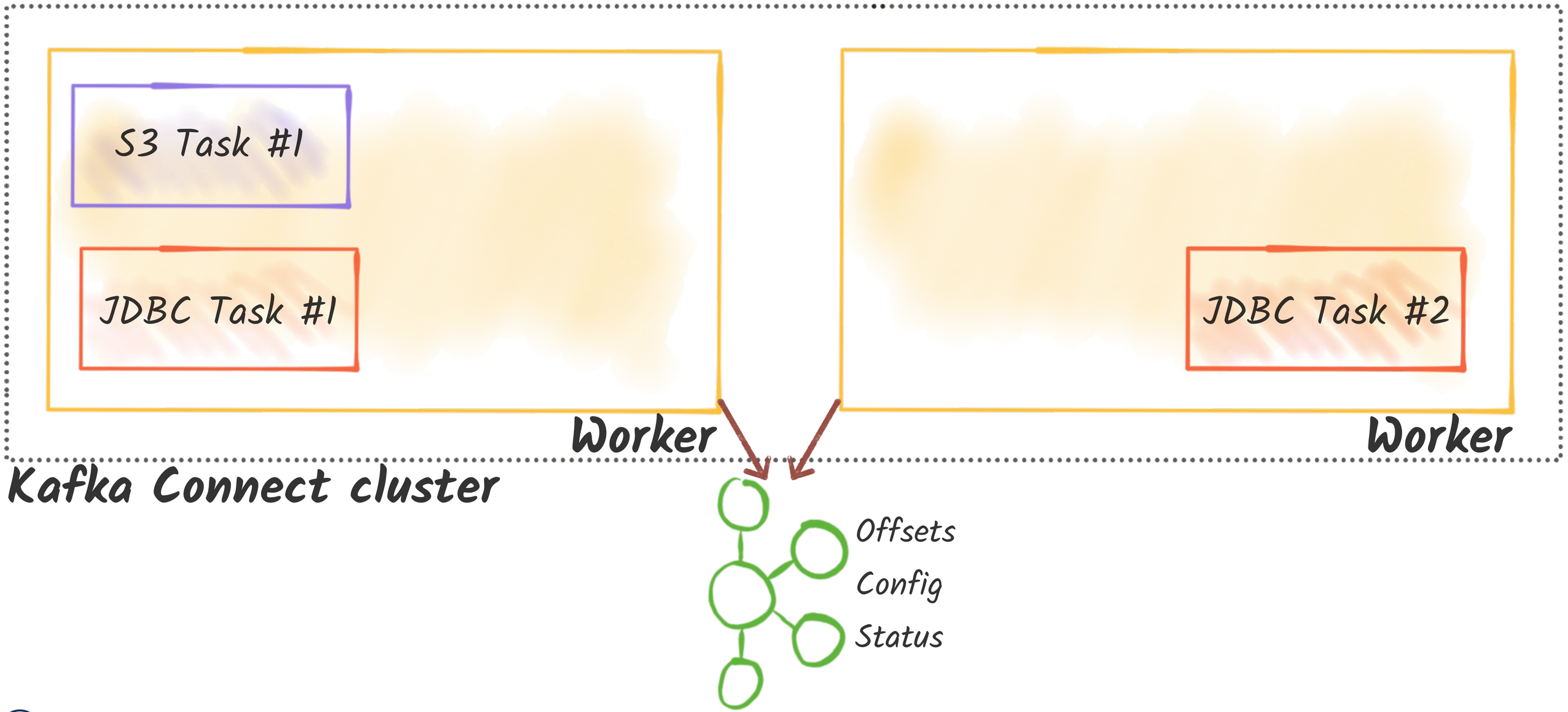
hub.confluent.io



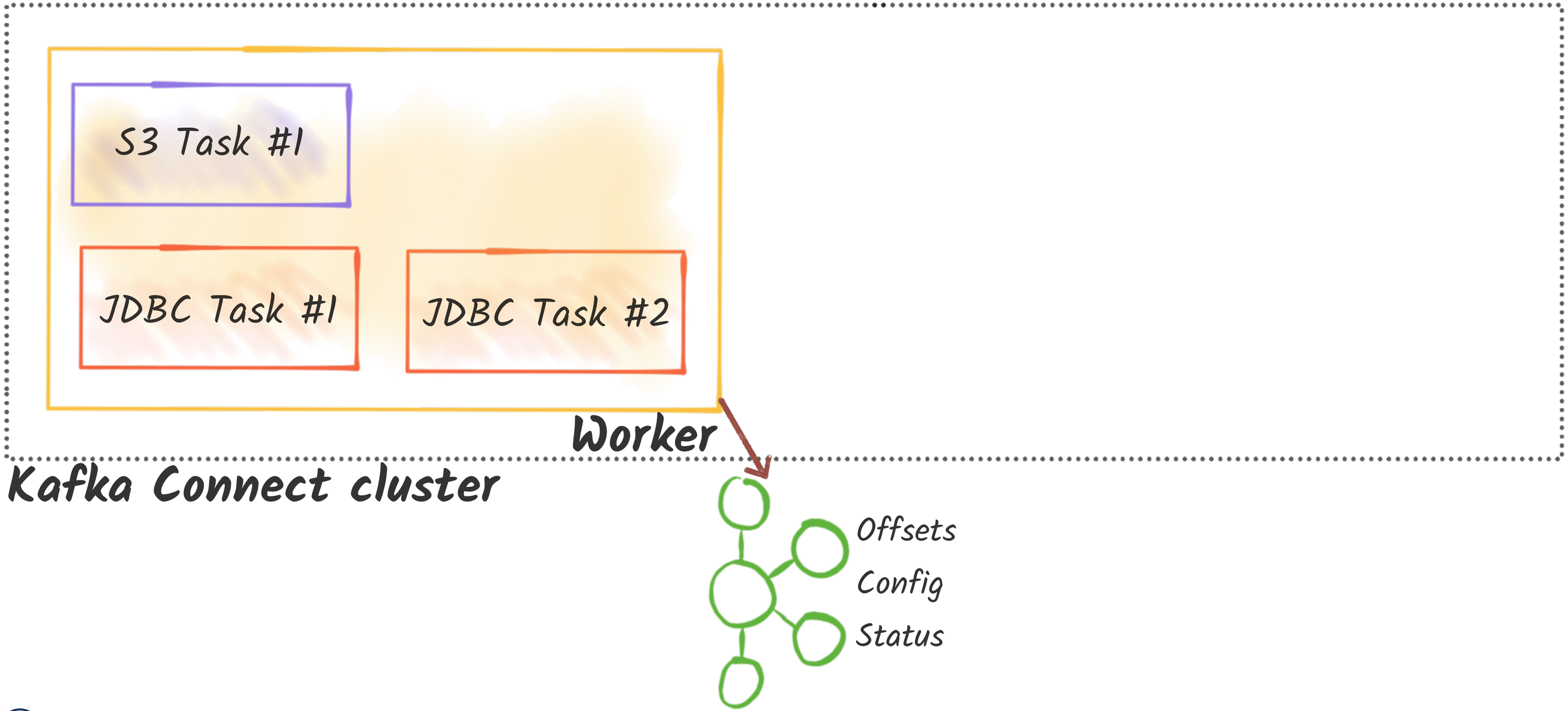
Single Kafka Connect node



Kafka Connect - scalable and fault-tolerant



Automatic fault tolerance

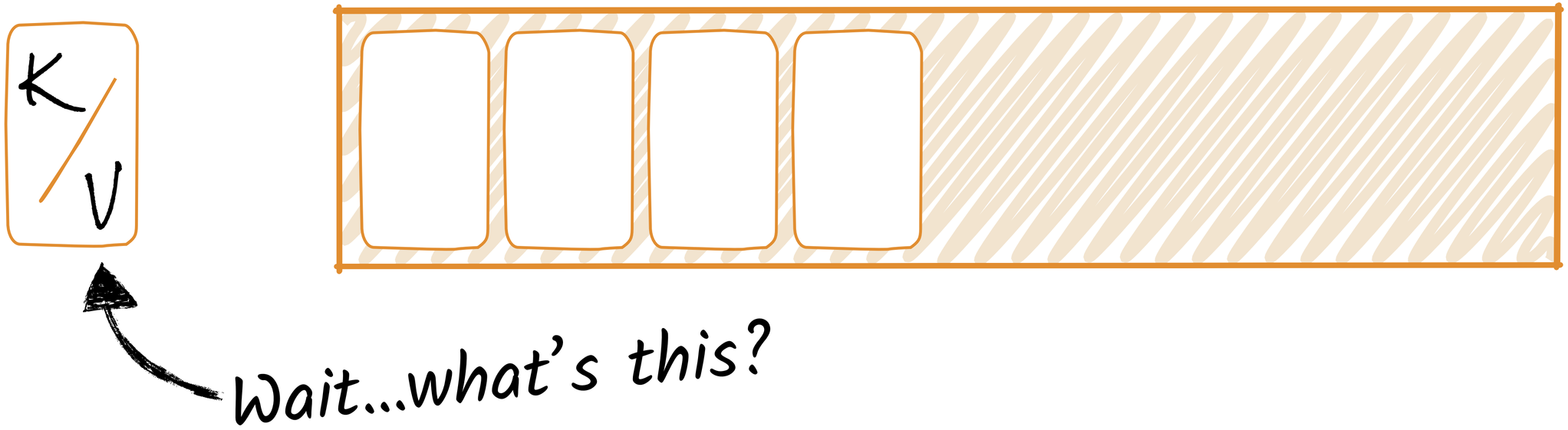


K
V

K
V

K
V

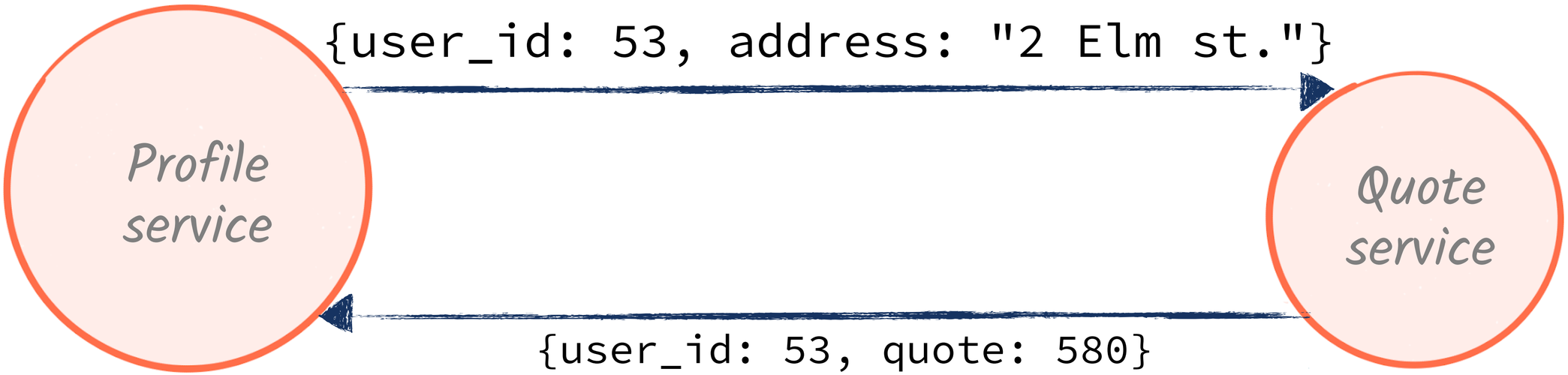
K
V


K
V
Wait...what's this?

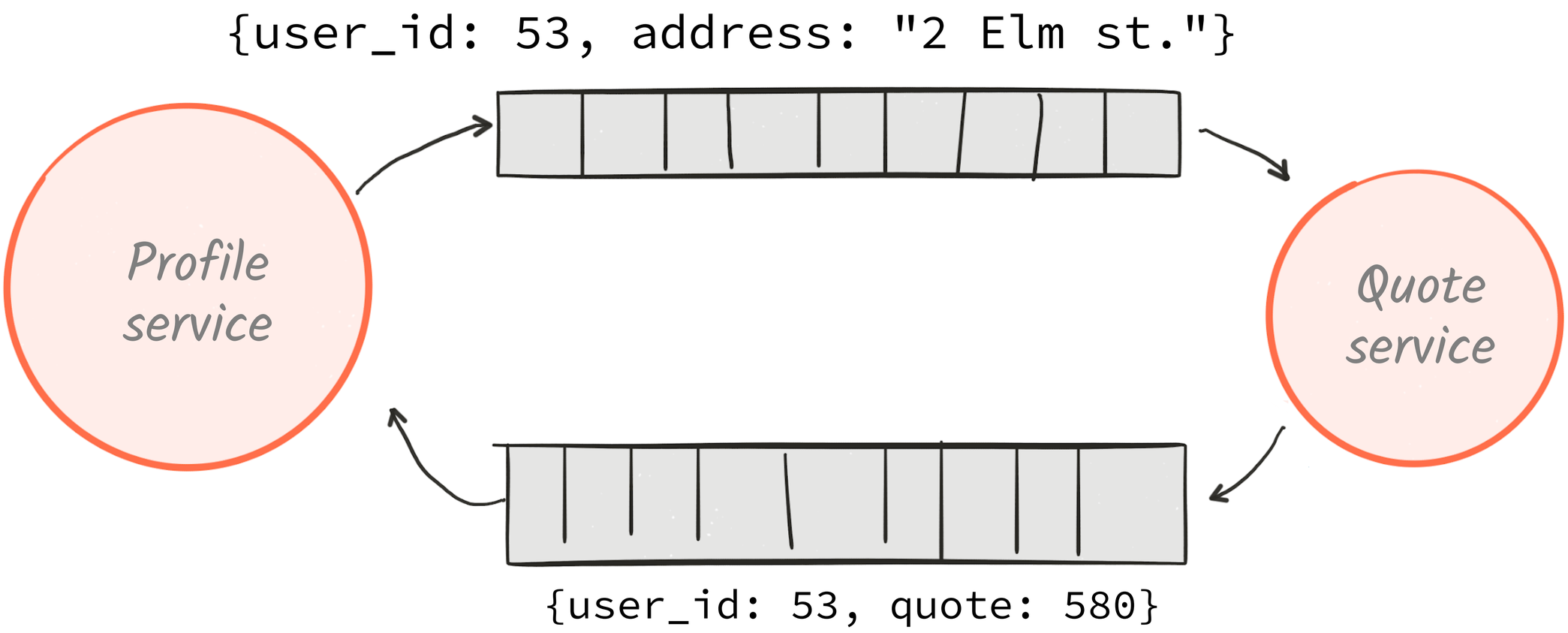
How do you serialise your data?

Avro Protobuf JSON Schema JSON CSV

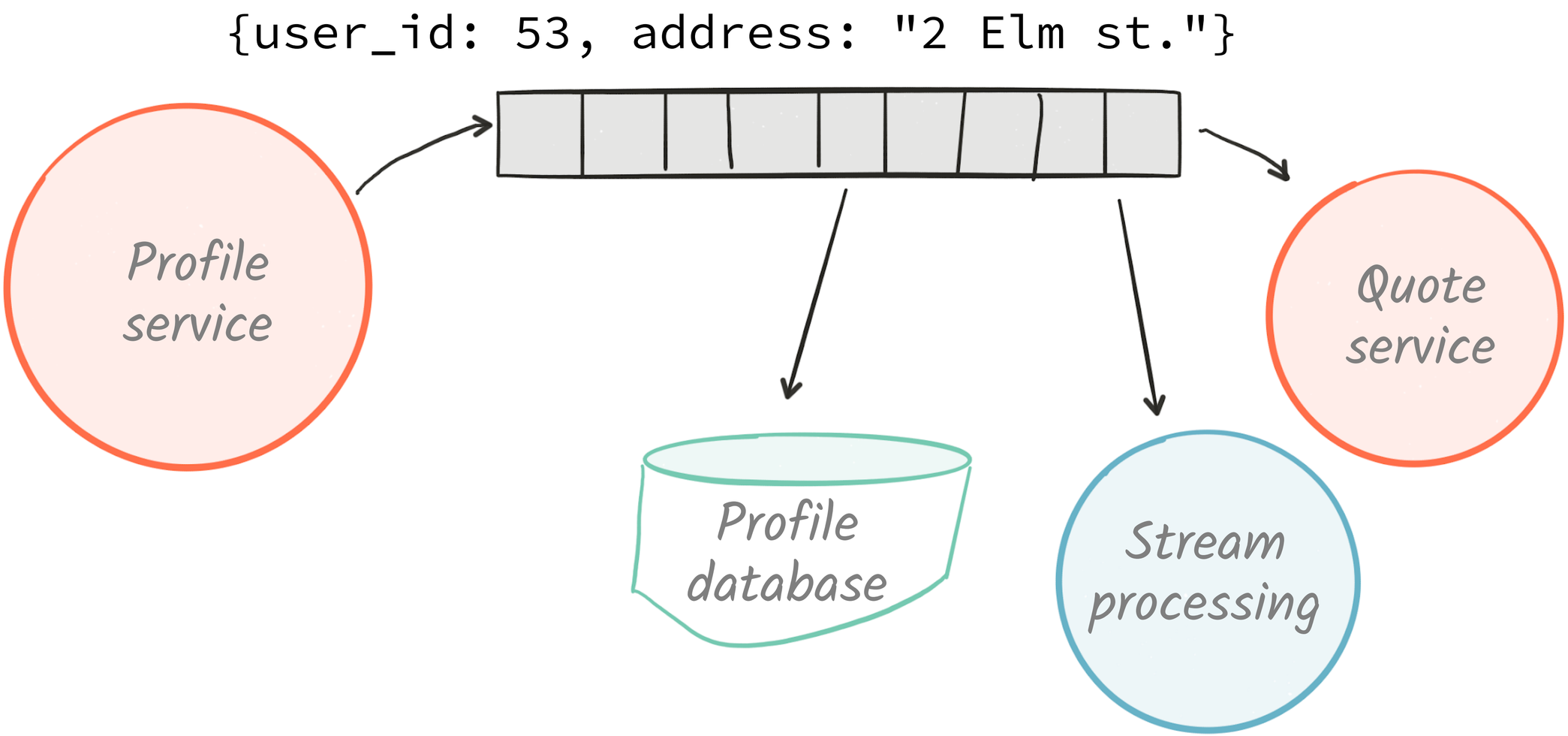
APIs are contracts between services



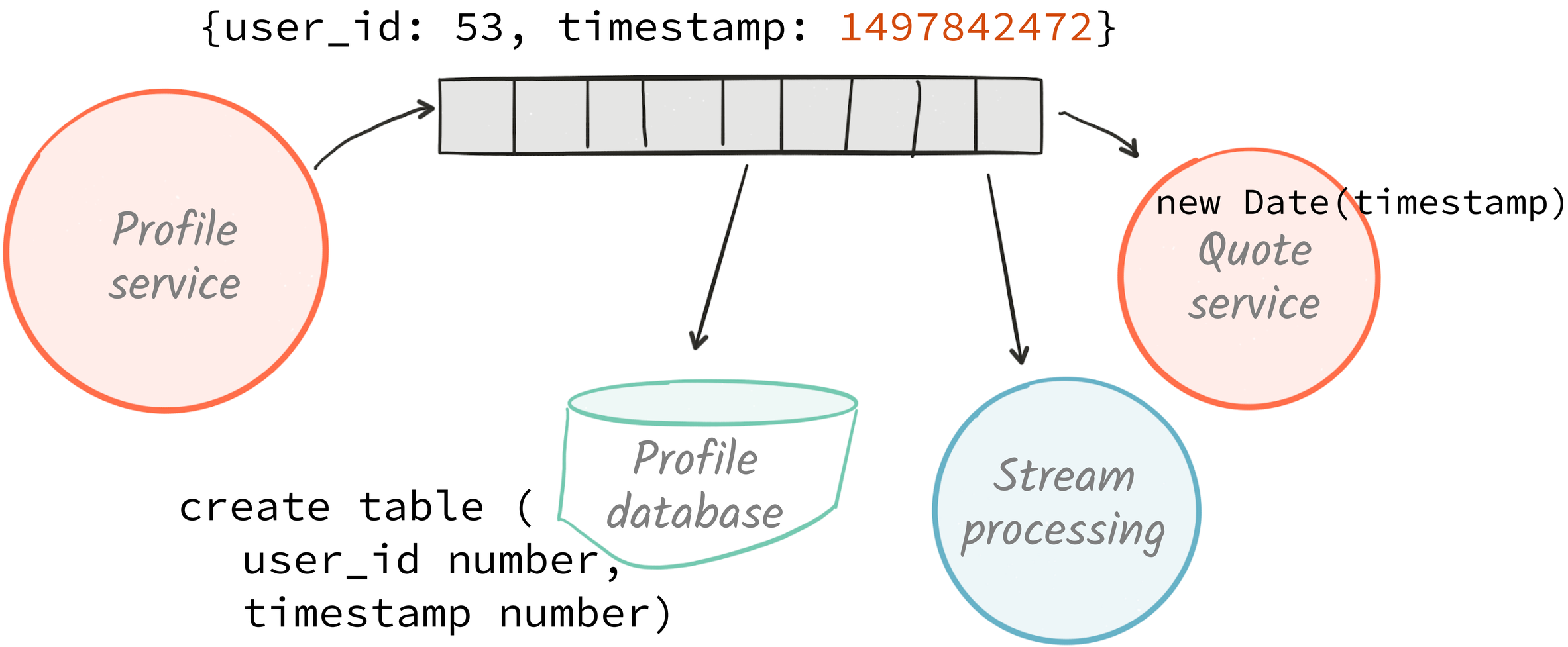
But not all services



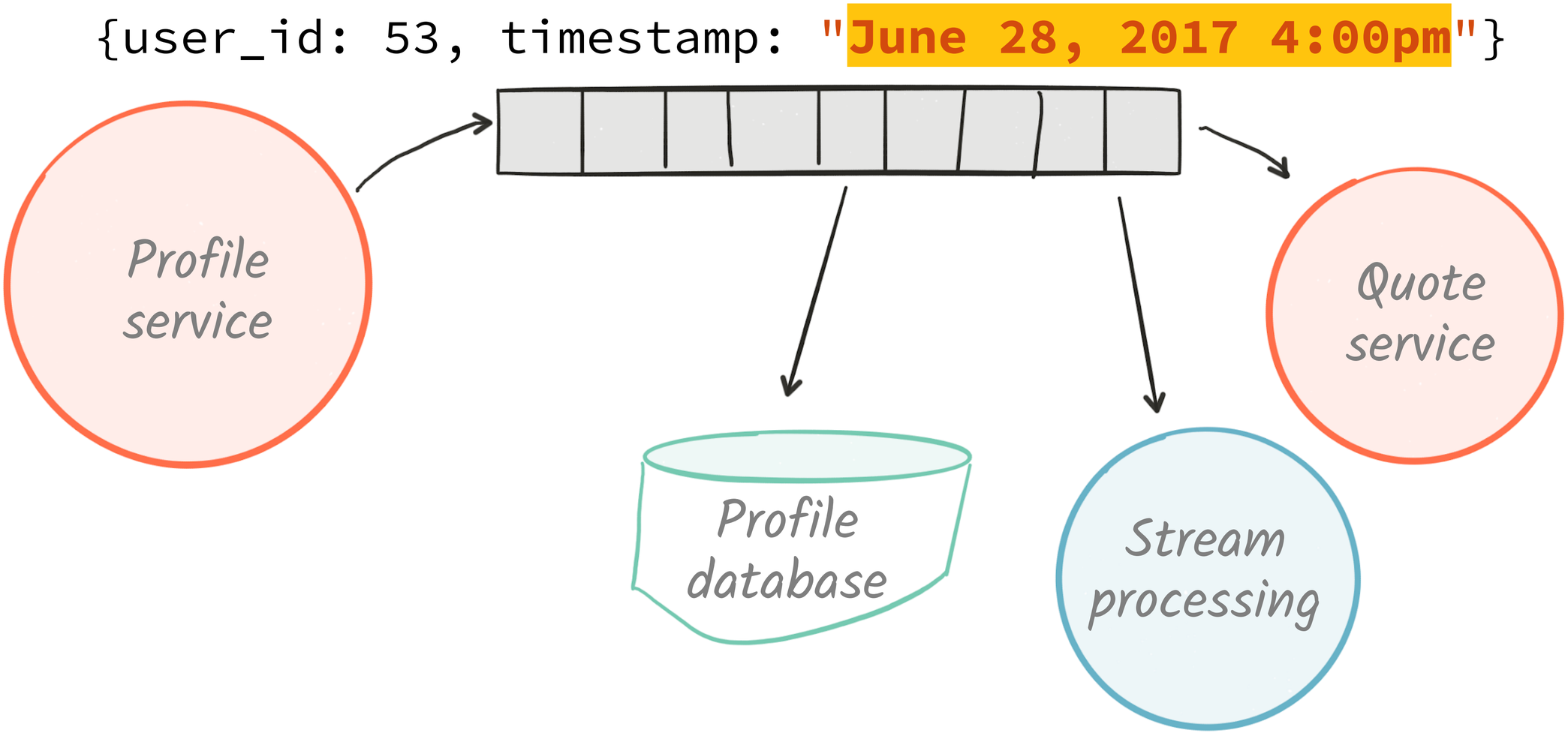
And naturally...



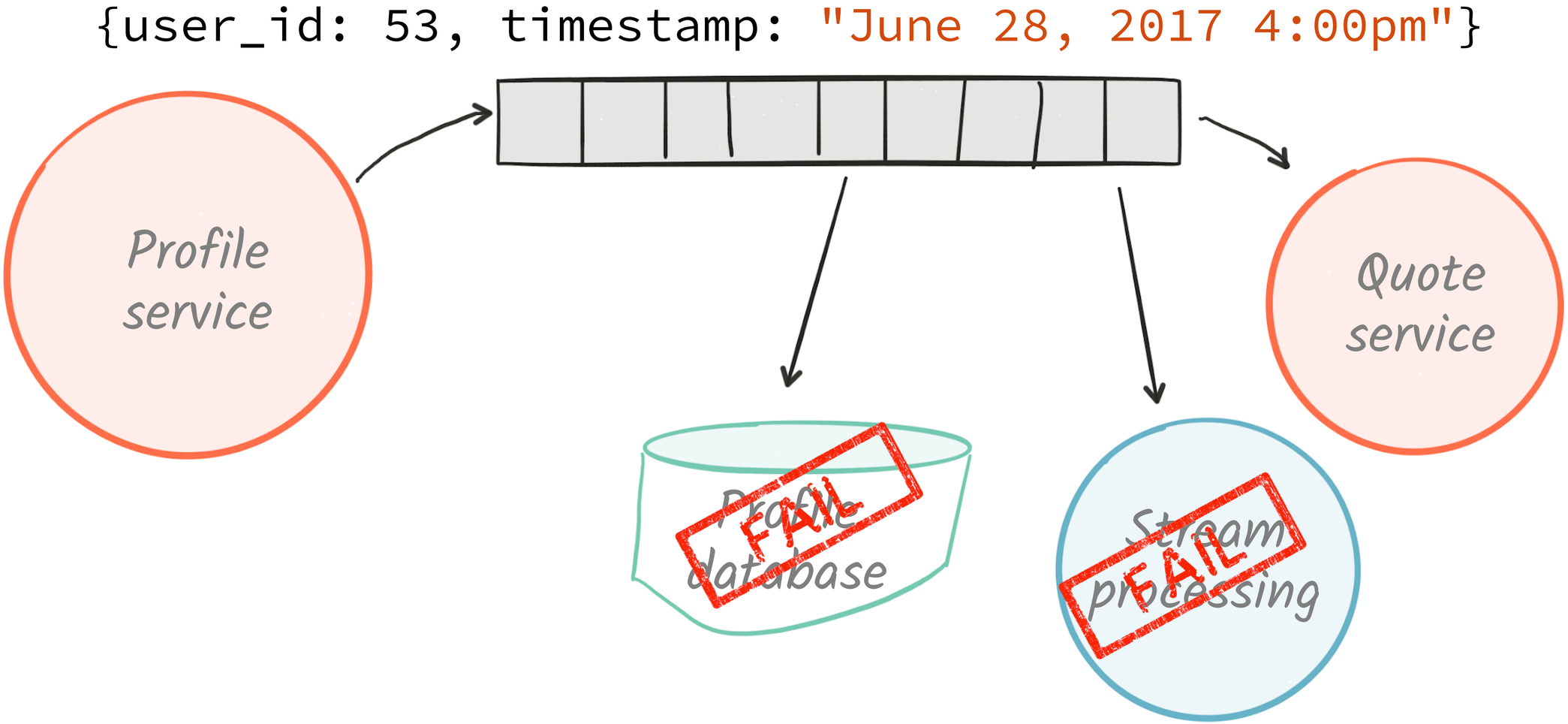
Schemas are about how teams work together



Things change...



Moving fast and breaking things



Lack of schemas - Coupling teams and services

```
2001 2001 Citrus Heights-Sunrise Blvd
Citrus_Hghts 60670001  3400293 34 SAC
Sacramento SV Sacramento Valley SAC
Sacramento County APCD SMA8 Sacramento
Metropolitan Area CA 6920 Sacramento 28 6920
13588 7400 Sunrise Blvd9561038 41 56
38.6988889 121  16 15.98999977
-121.271111  10 4284781 650345  52
```

Serialisation & Schemas

Avro Protobuf JSON Schema JSON CSV

Serialisation & Schemas

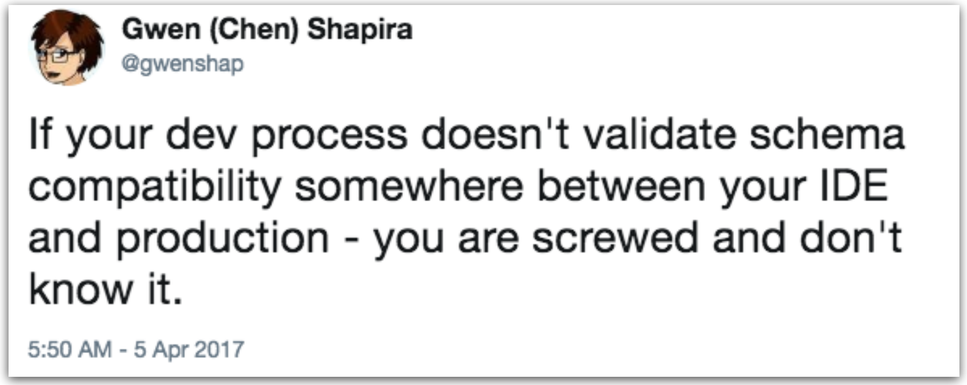
Avro 👍

Protobuf 👍

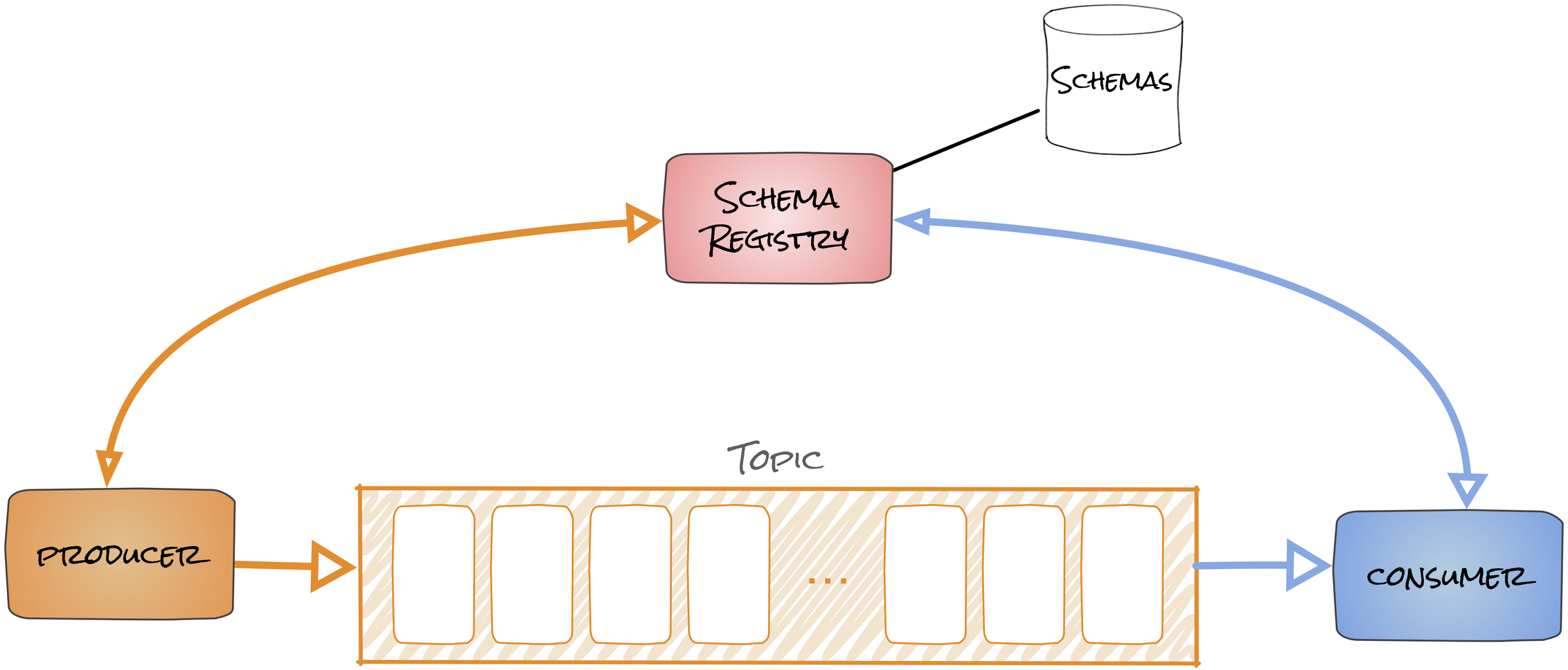
JSON Schema 👍

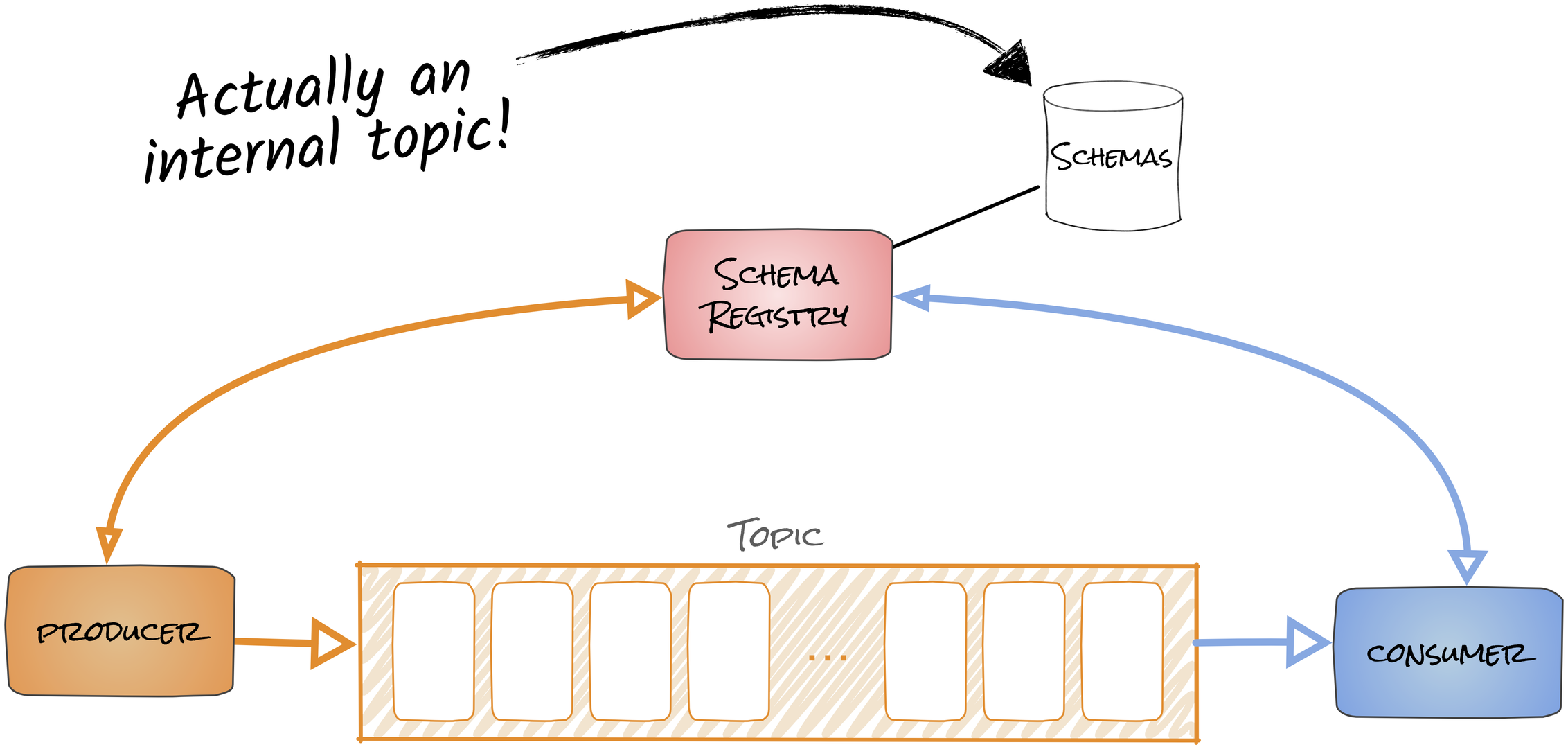
JSON 😬

CSV



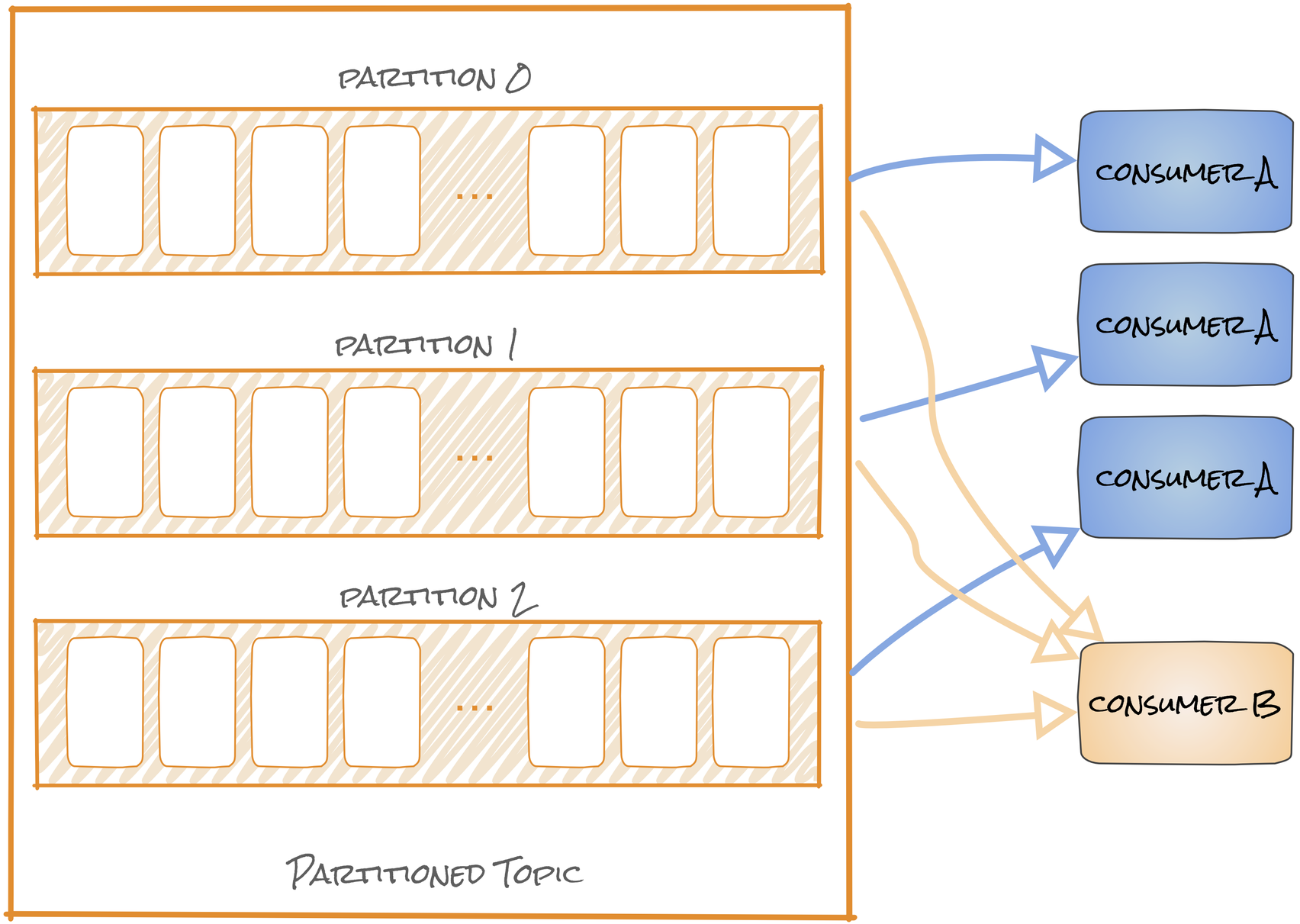
https://qconnewyork.com/system/files/presentation-slides/qcon_17_-_schemas_and_apis.pdf


SCHEMAS
SCHEMA REGISTRY
TOPIC
PRODUCER
CONSUMER


Actually an internal topic!
Schemas
Schema Registry
Topic
Producer
Consumer

Producers contain serializers

```
props.put("key.serializer",
    "org.apache.kafka.serializers.StringSerializer");
props.put("value.serializer",
    "io.confluent.kafka.serializers.KafkaAvroSerializer");
props.put("schema.registry.url",
          "http://schema-registry:8081");
…
producer<String, LogLine> producer = new
  KafkaProducer<String, LogLine>(props);
```


PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A
CONSUMER A
CONSUMER A
CONSUMER B

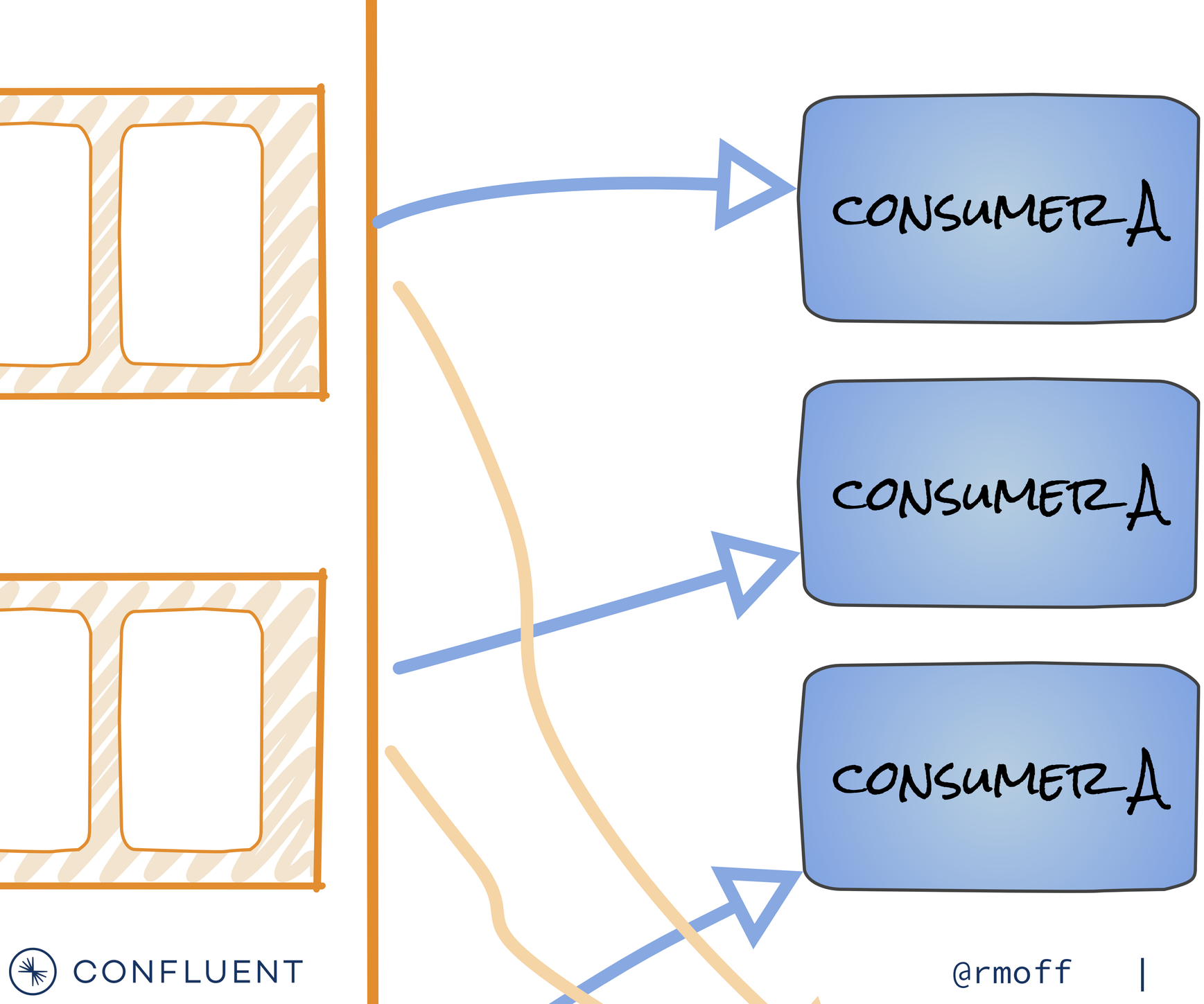
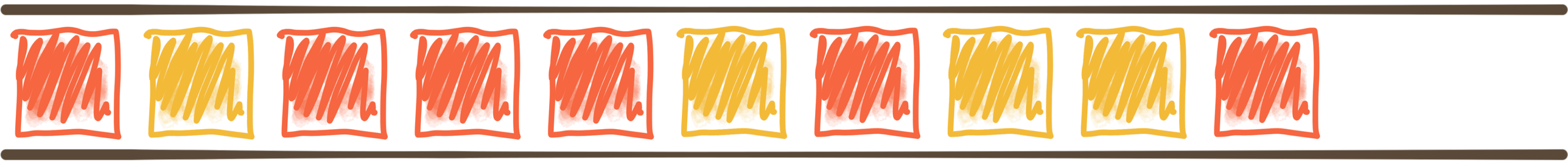

CONSUMER A
CONSUMER A
CONSUMER A

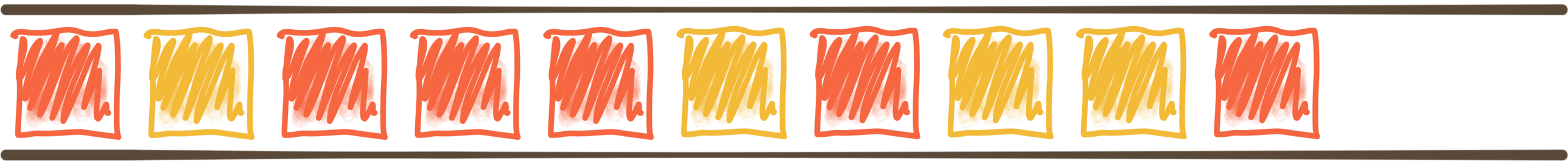
Photo by Franck V. on Unsplash

Streams of events



Time

Stream Processing



Stream: widgets

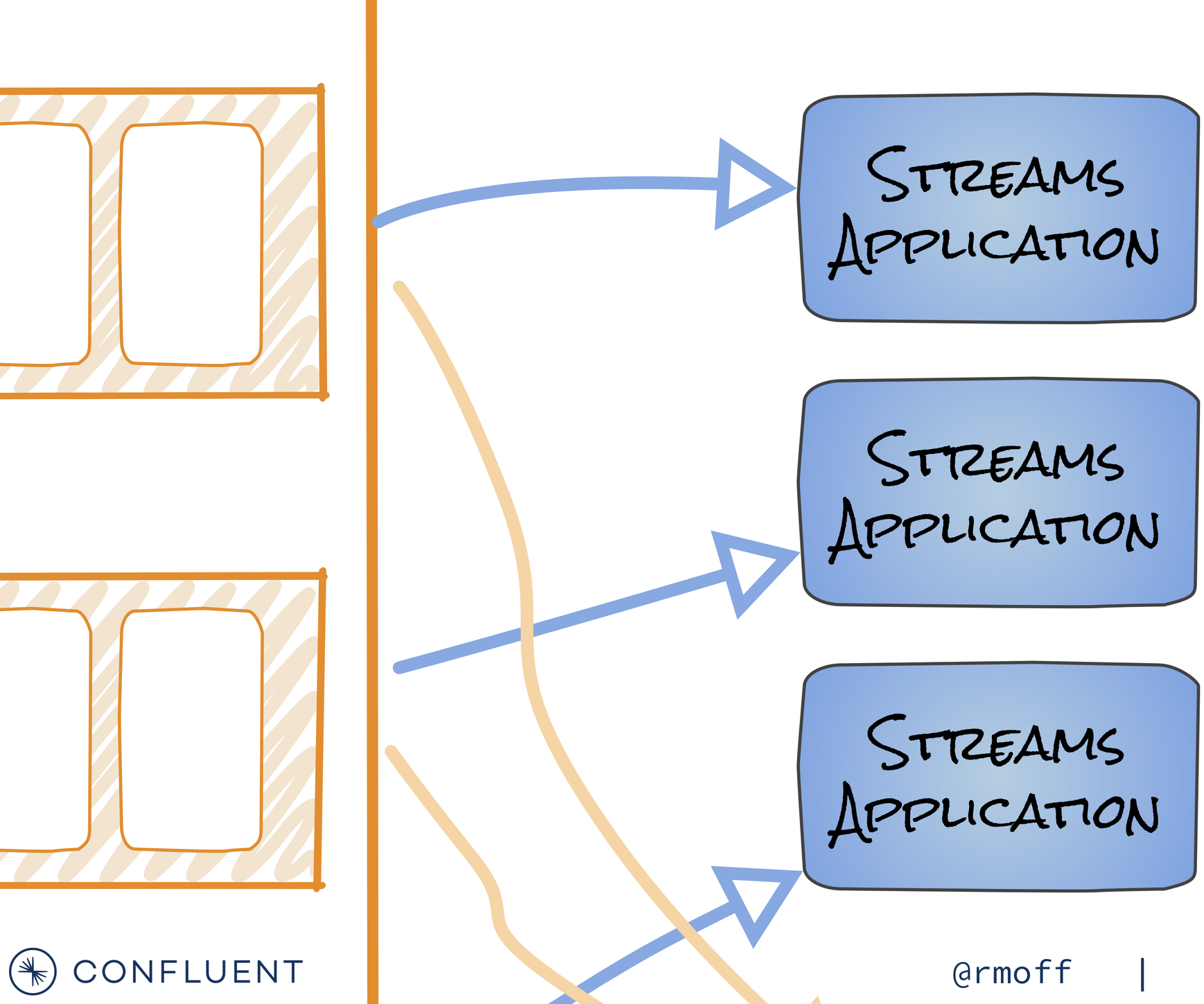
Stream: widgets_red

Stream Processing with Kafka Streams

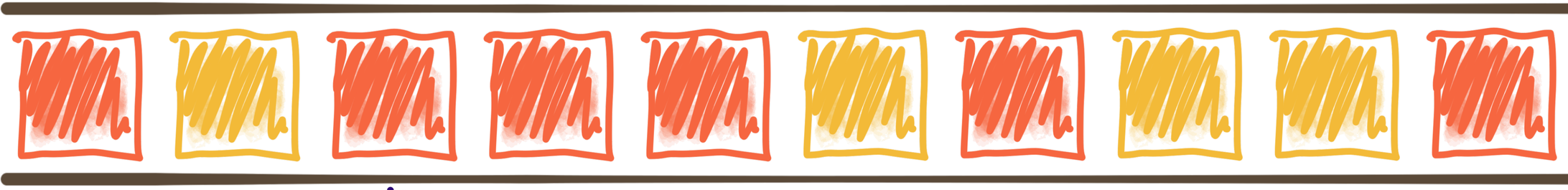
Stream:
widgets

```
final StreamsBuilder builder = new StreamsBuilder()
    .stream("widgets", Consumed.with(stringSerde, widgetsSerde))
    .filter( (key, widget) -> widget.getColour().equals("RED") )
    .to("widgets_red", Produced.with(stringSerde, widgetsSerde));
```

Stream:
widgets_red


Streams Application
Streams Application
Streams Application

Stream Processing with ksqlDB



Stream:
widgets

ksqlDB

```
CREATE STREAM widgets_red AS
SELECT * FROM widgets
WHERE colour='RED';
```

Stream:
widgets_red

Photo by Franck V. on Unsplash

```
SELECT *
FROM WIDGETS
WHERE WEIGHT_G > 120
```

```
SELECT COUNT(*)
FROM WIDGETS
GROUP BY PRODUCTION_LINE
```

```
SELECT AVG(TEMP_CELCIUS) AS TEMP
FROM WIDGETS
GROUP BY SENSOR_ID
HAVING TEMP>20
```

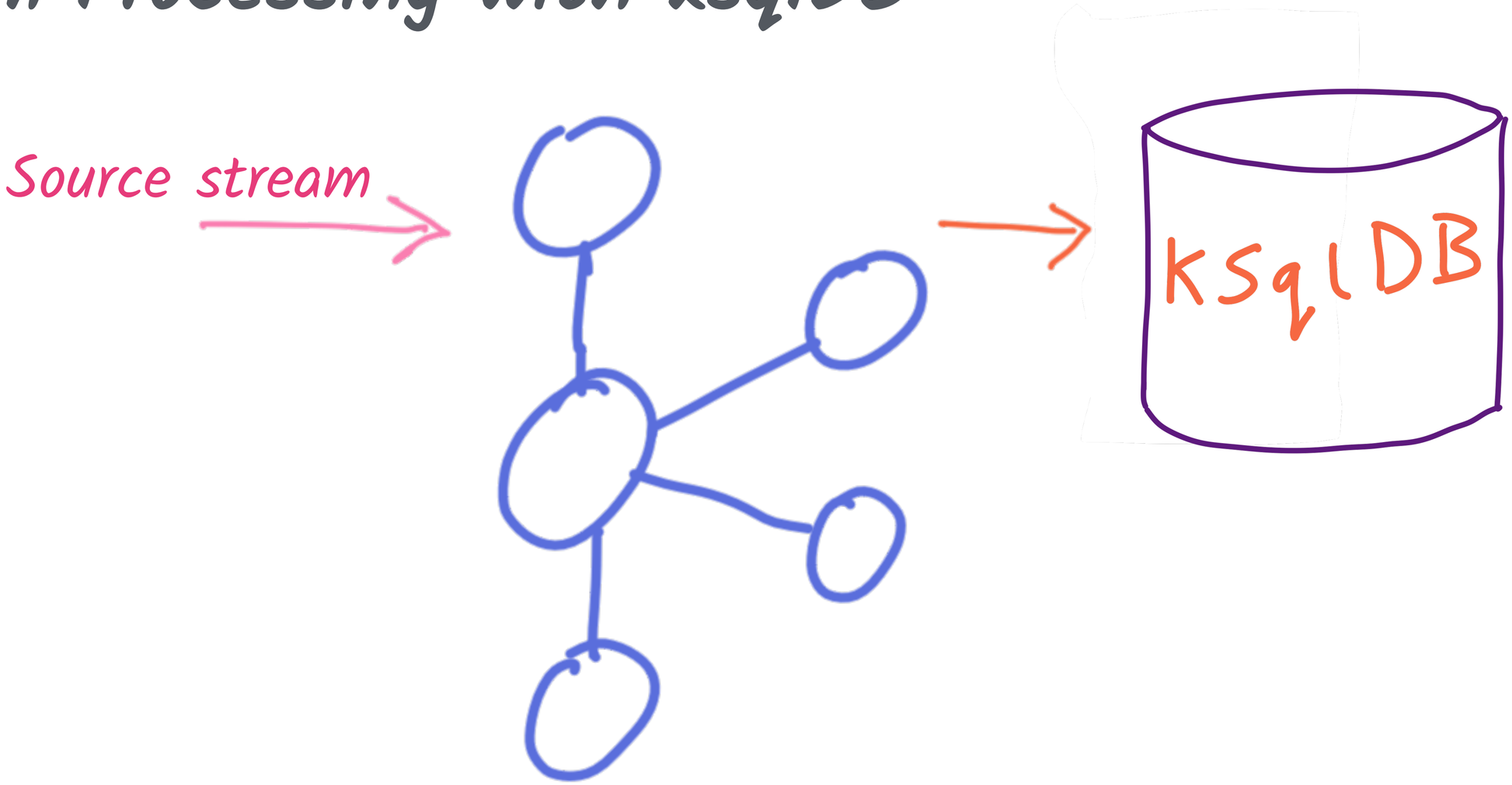
```
{
    "reading_ts": "2020-02-14T12:19:27Z",
    "sensor_id": "aa-101",
    "production_line": "w01",
    "widget_type": "acme94",
    "temp_celcius": 23,
    "widget_weight_g": 100
}
```

Object store, data warehouse, RDBMS

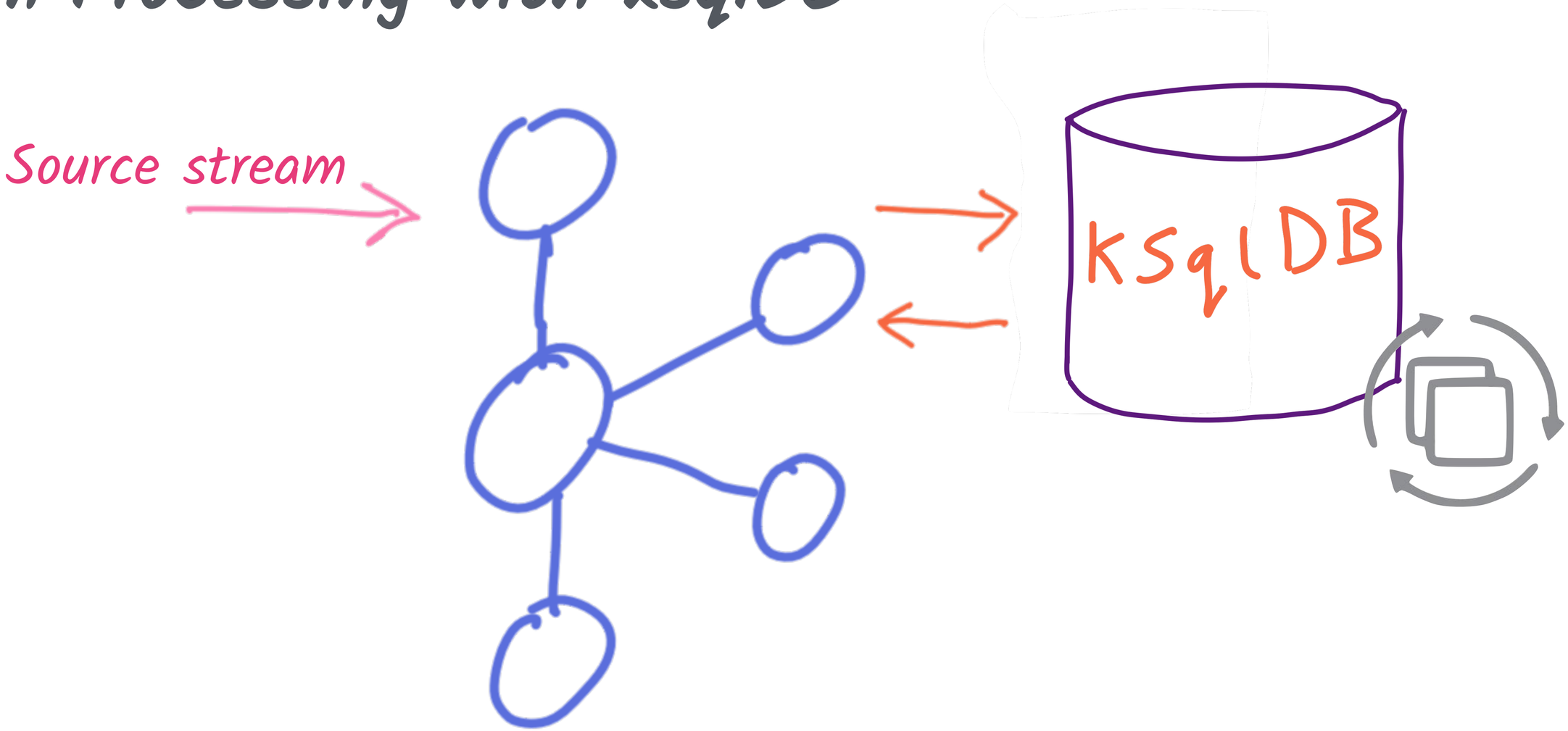
```
CREATE SINK CONNECTOR dw WITH (
'connector.class' = 'S3Connector',
'topics' = 'widgets'
…);
```

Photo by Franck V. on Unsplash

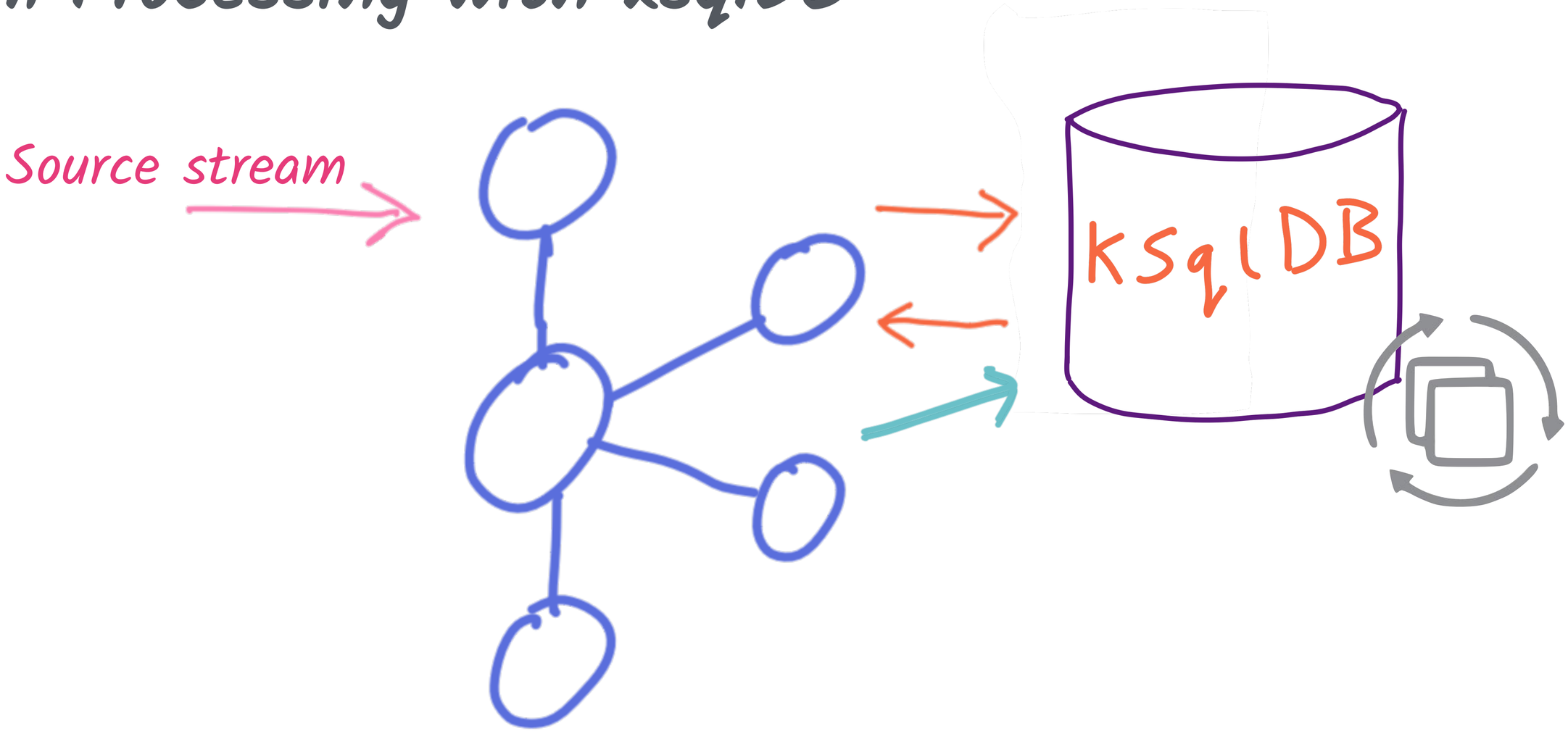
Stream Processing with ksqlDB



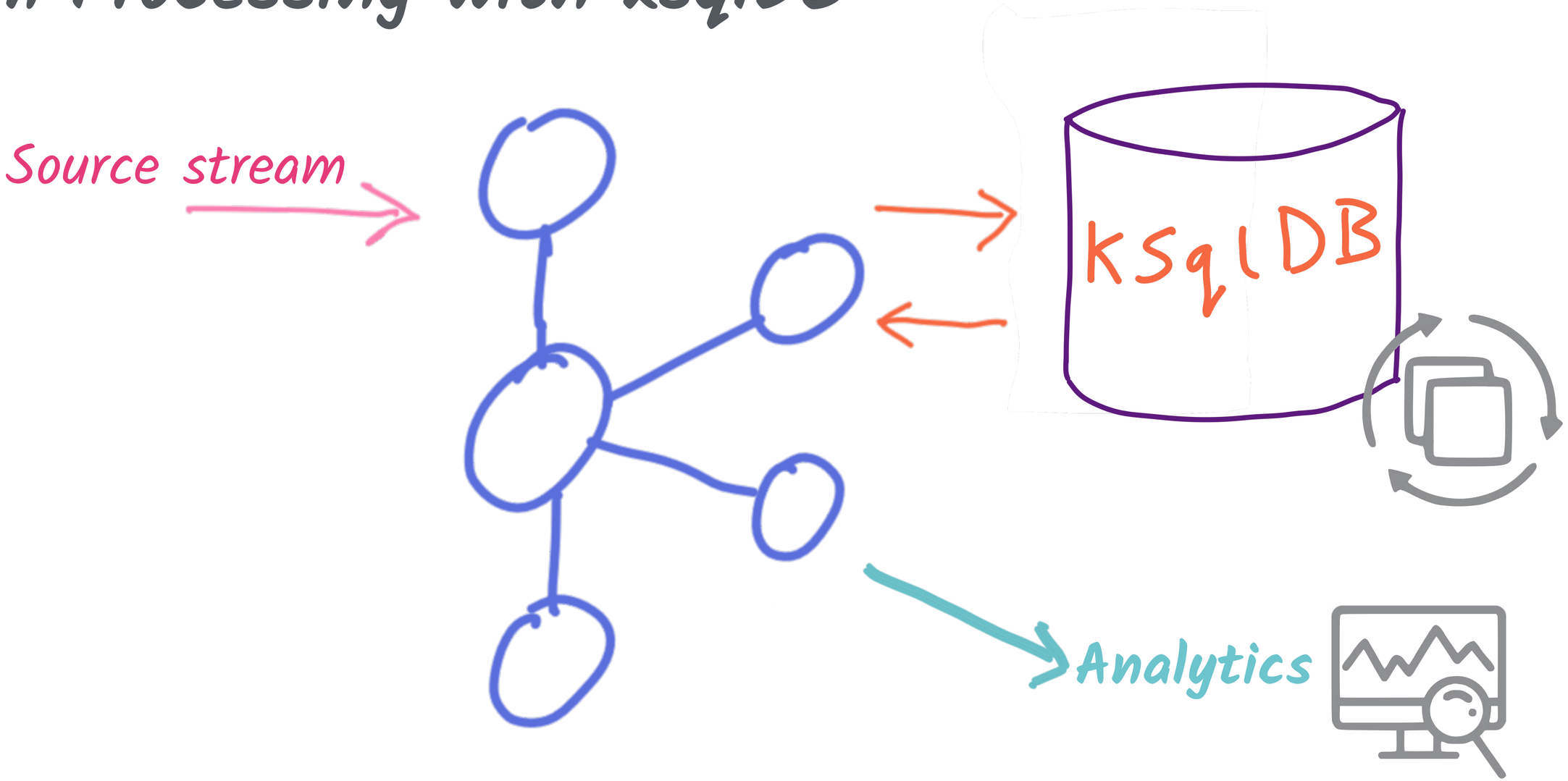
Stream Processing with ksqlDB



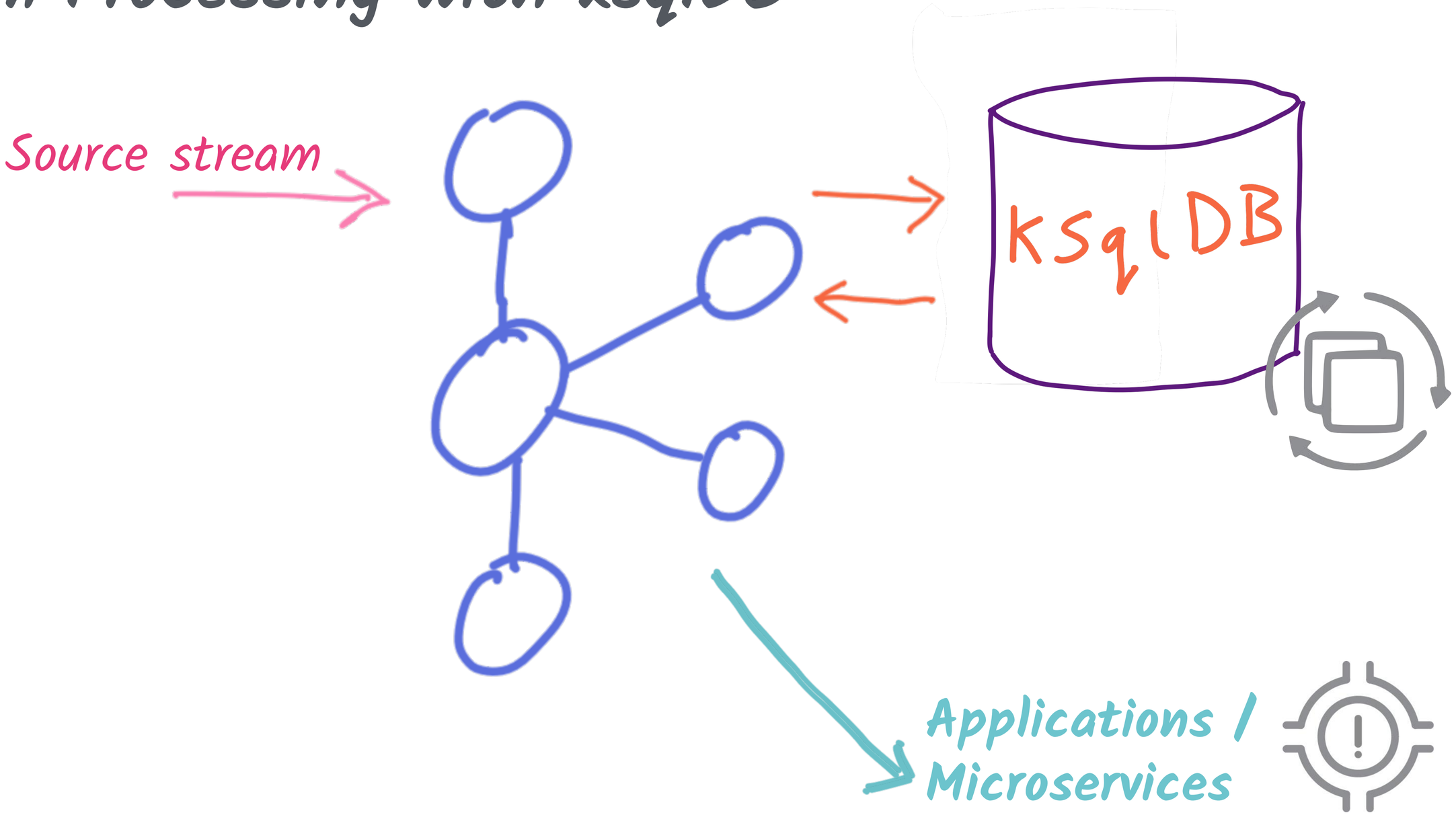
Stream Processing with ksqlDB



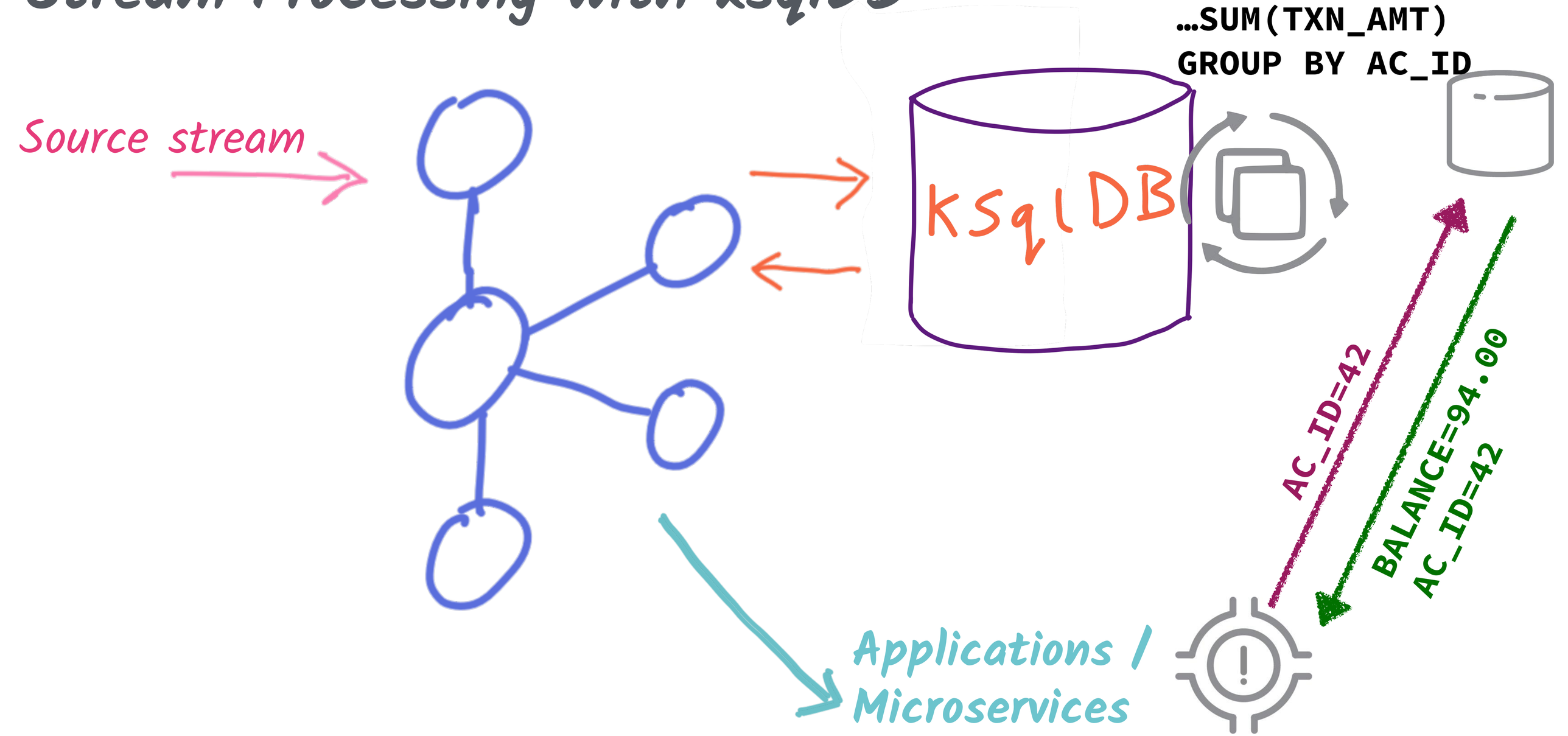
Stream Processing with ksqlDB



Stream Processing with ksqlDB



Stream Processing with ksqlDB



CONFLUENT

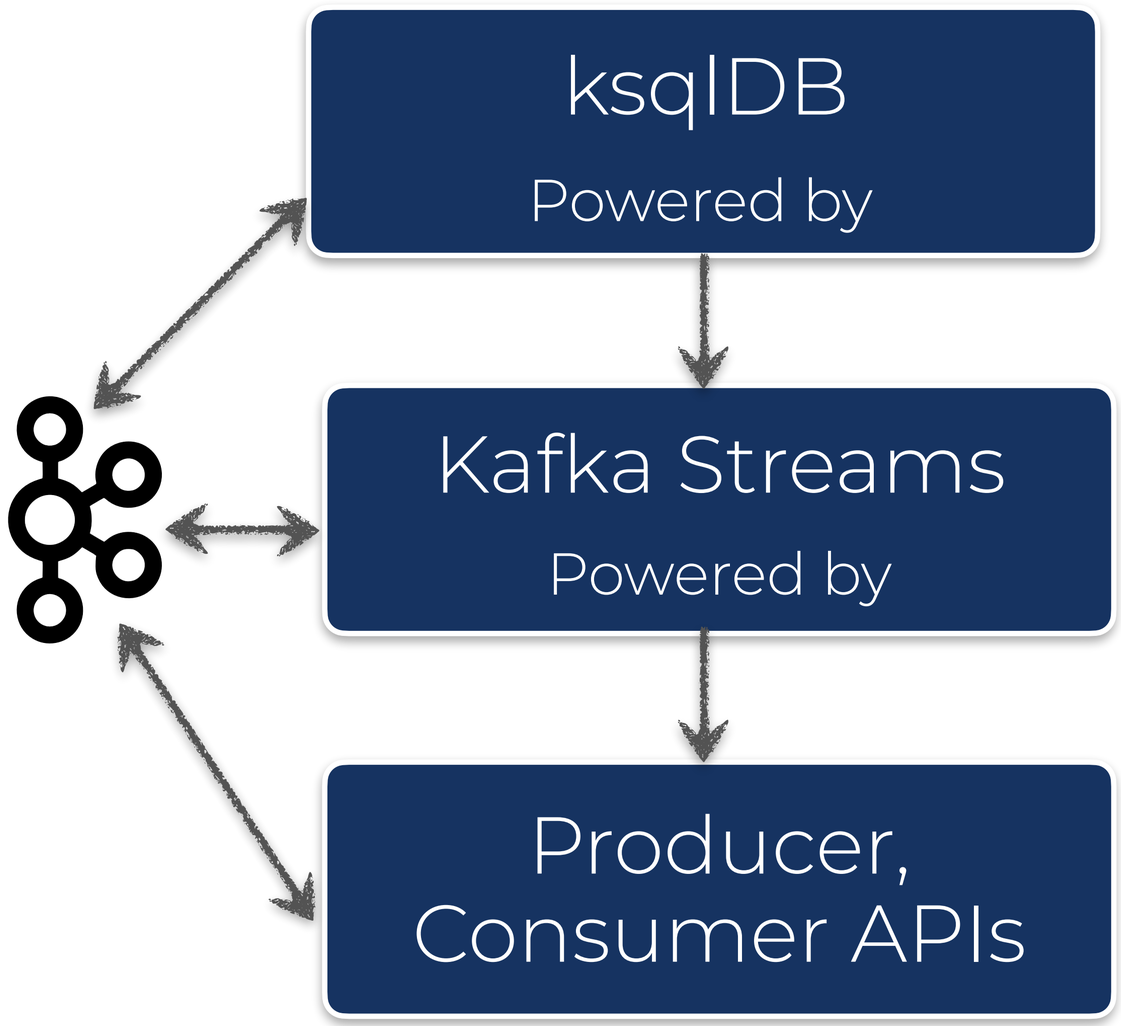
ksqlDB

or

Kafka Streams?

Photo by Ramiz Dedaković on Unsplash

Standing on the Shoulders of Streaming Giants



Ease of use

Flexibility

```
CREATE STREAM,
CREATE TABLE, SELECT, JOIN,
GROUP BY, SUM, …
```

ksqlDB UDFs

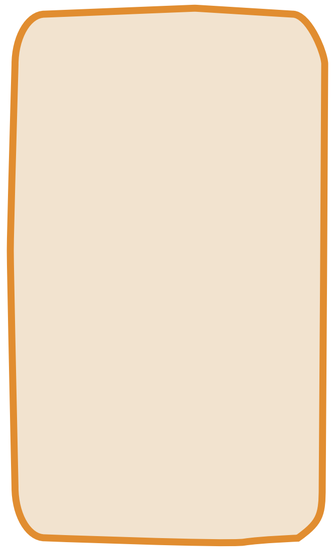
```
KStream<>, KTable<>, filter(), map(),
flatMap(), join(), aggregate(),
transform(), …
```

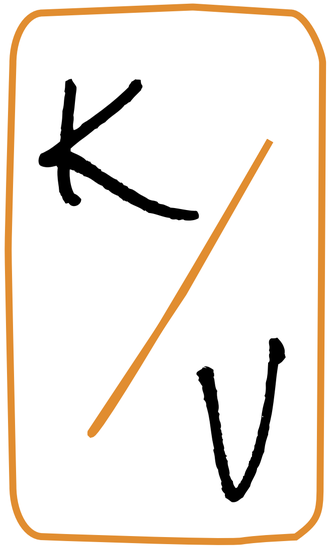
```
subscribe(), poll(), send(),
flush(), beginTransaction(), …
```

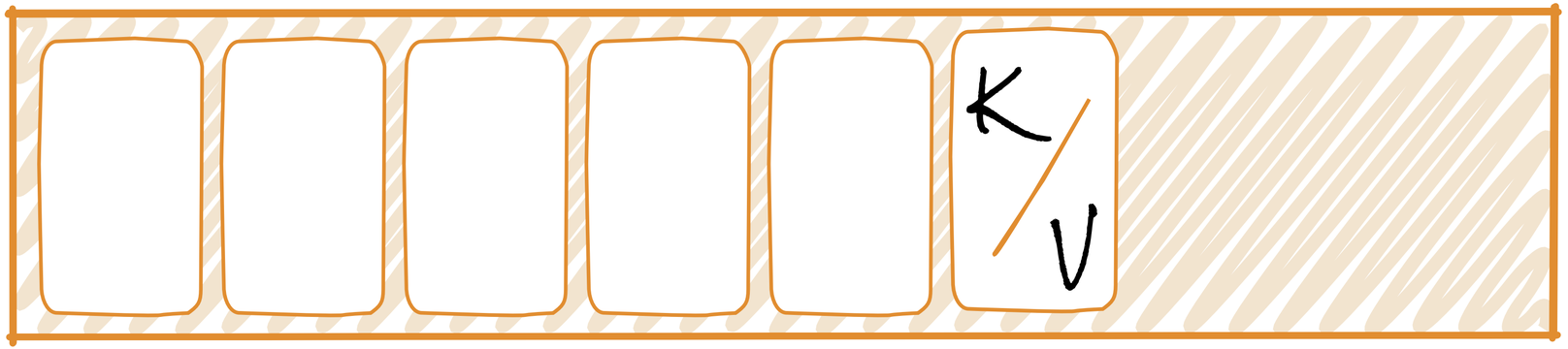
CONFLUENT

DEMO

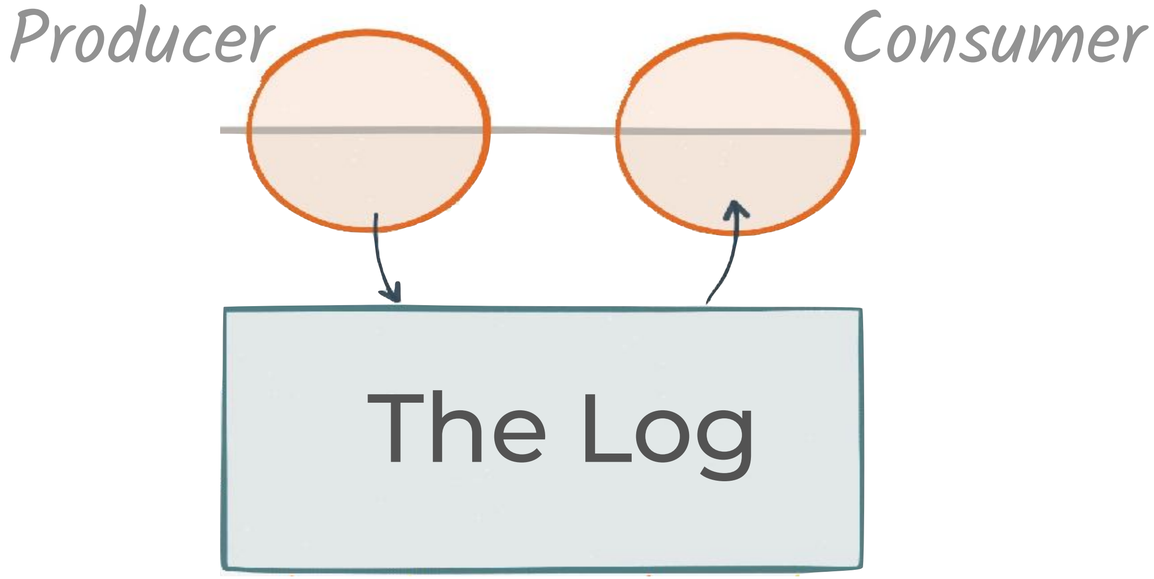
Summary

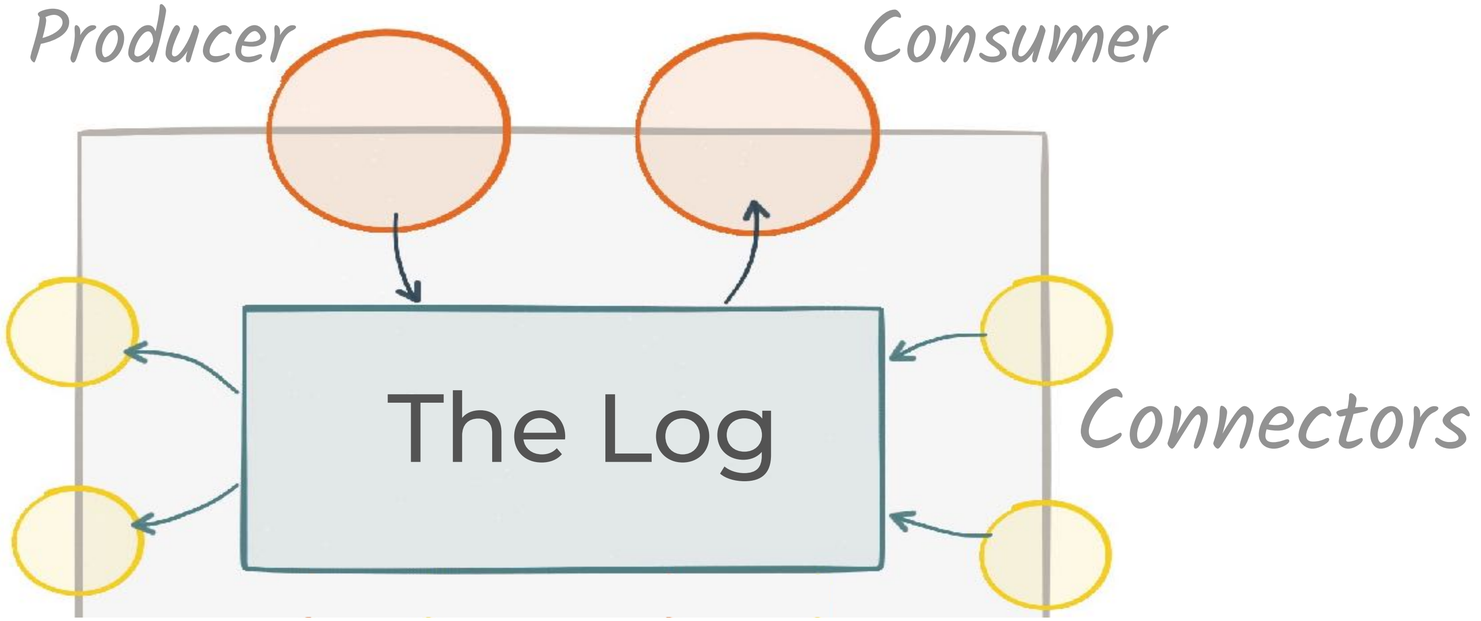


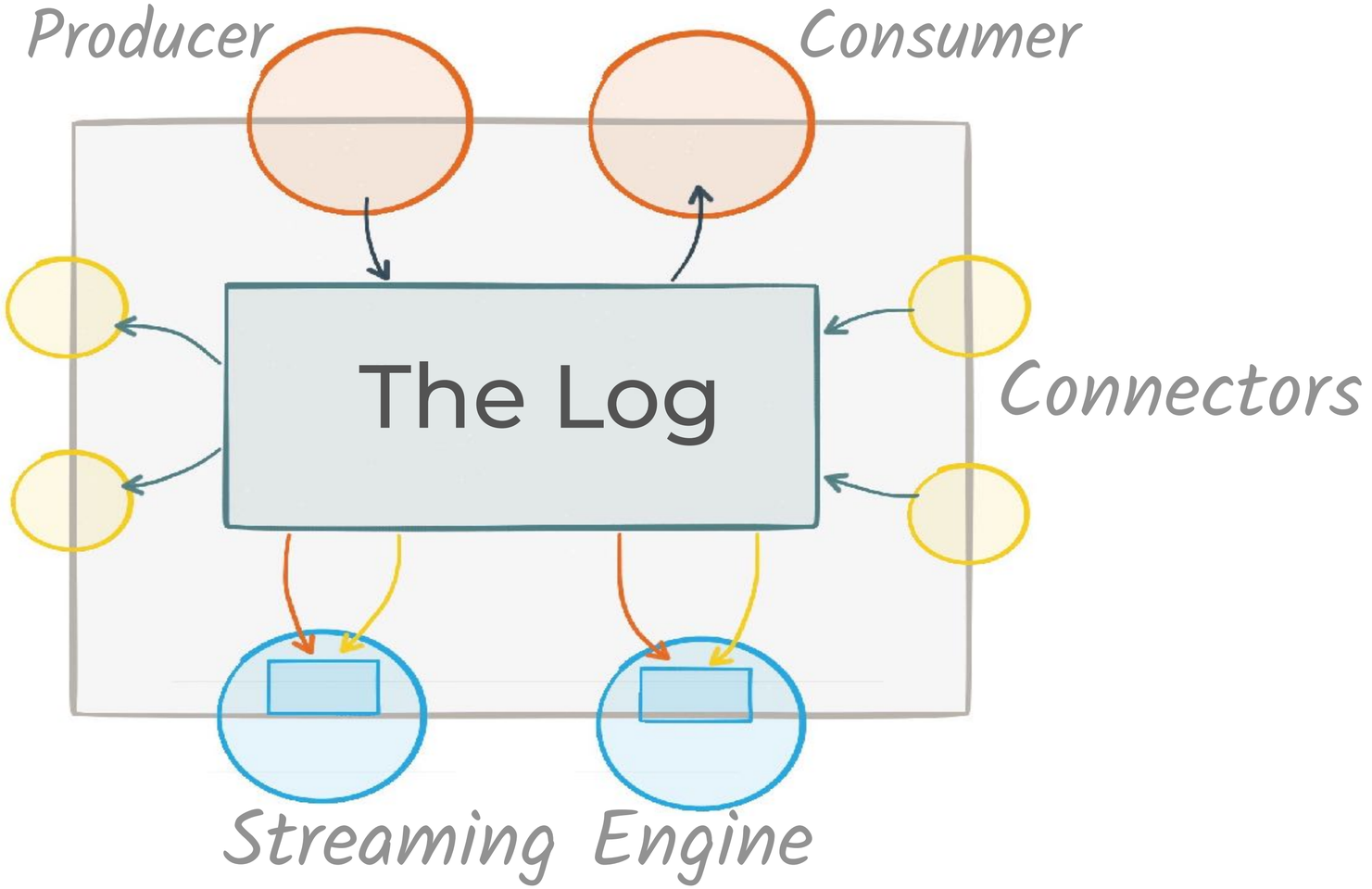

K
V


K
V

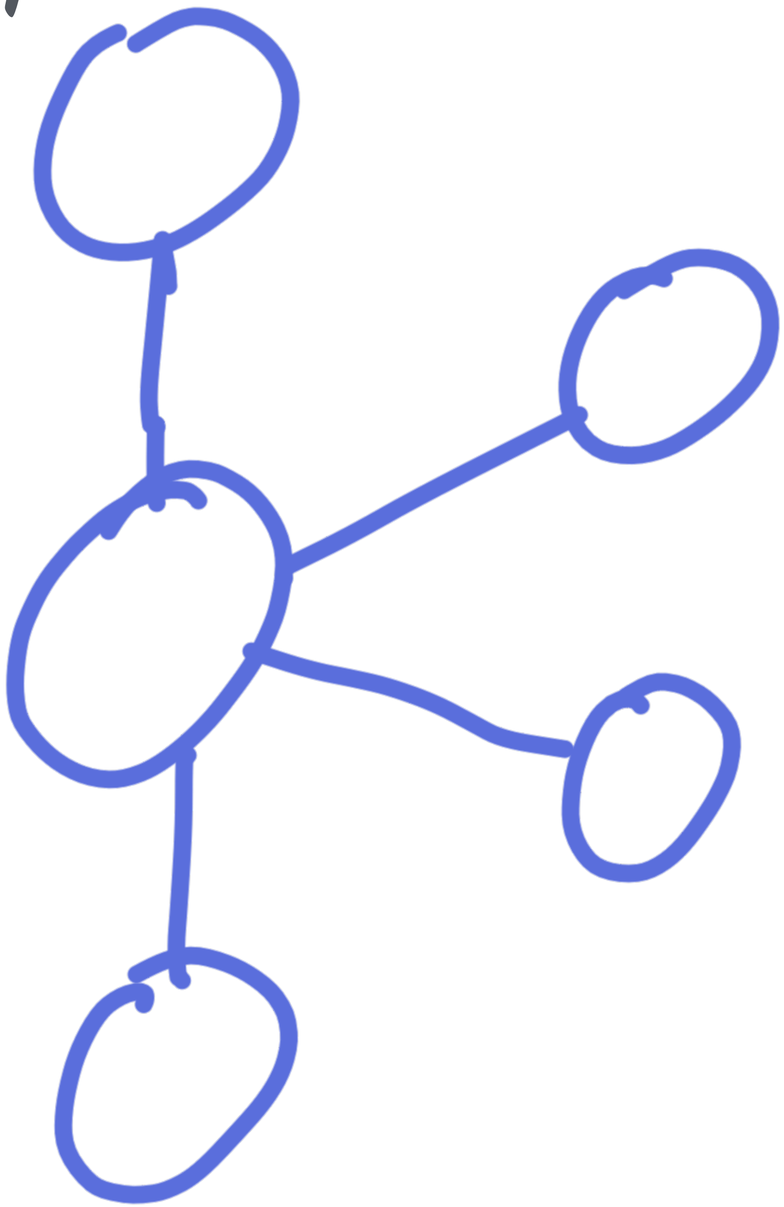
The Log

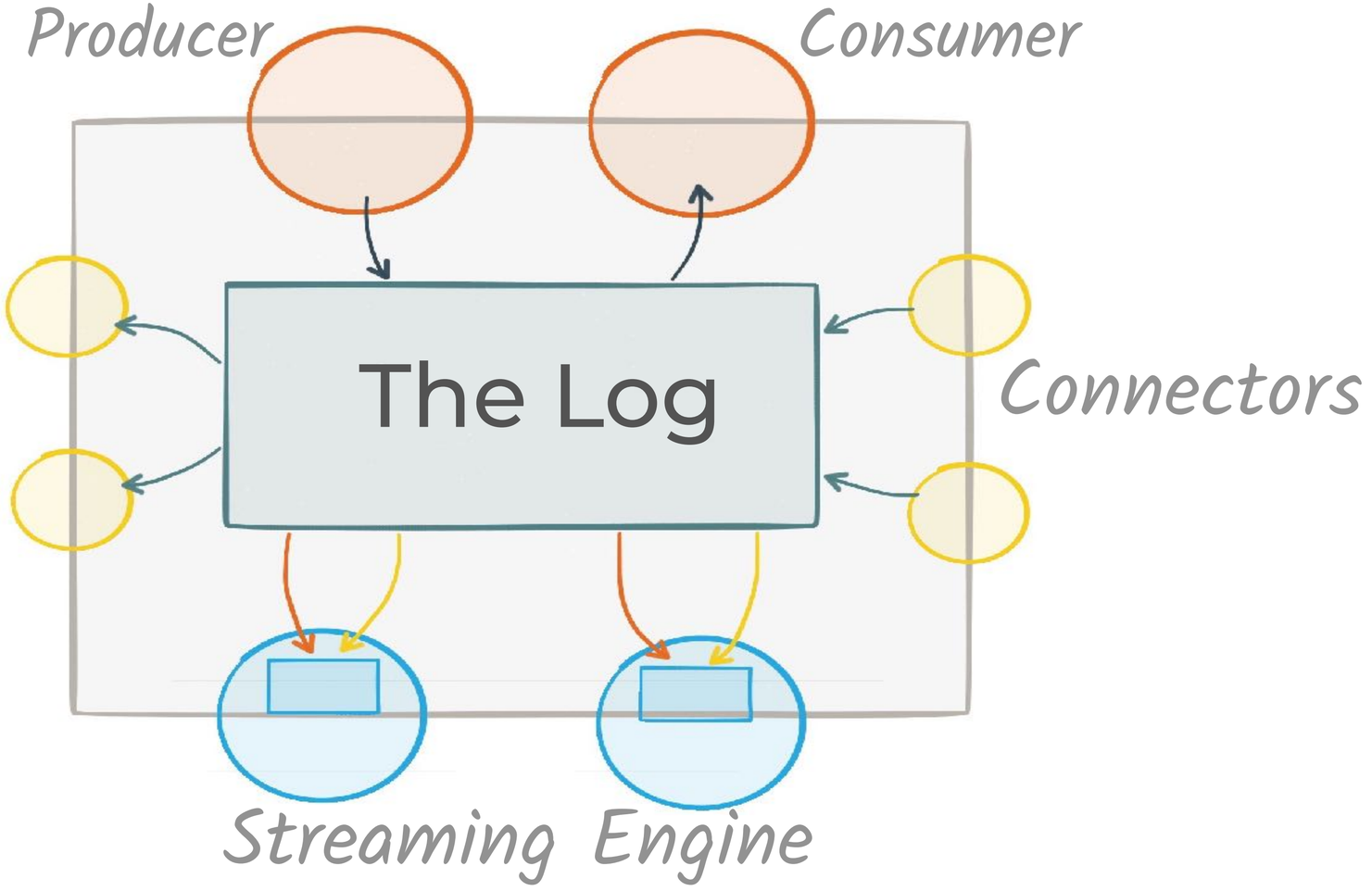

Producer
Consumer
The Log


Producer
Consumer
The Log
Connectors


Producer
Consumer
The Log
Connectors
Streaming Engine

Apache Kafka





EVENTS

are

EVERYWHERE

EVENTS

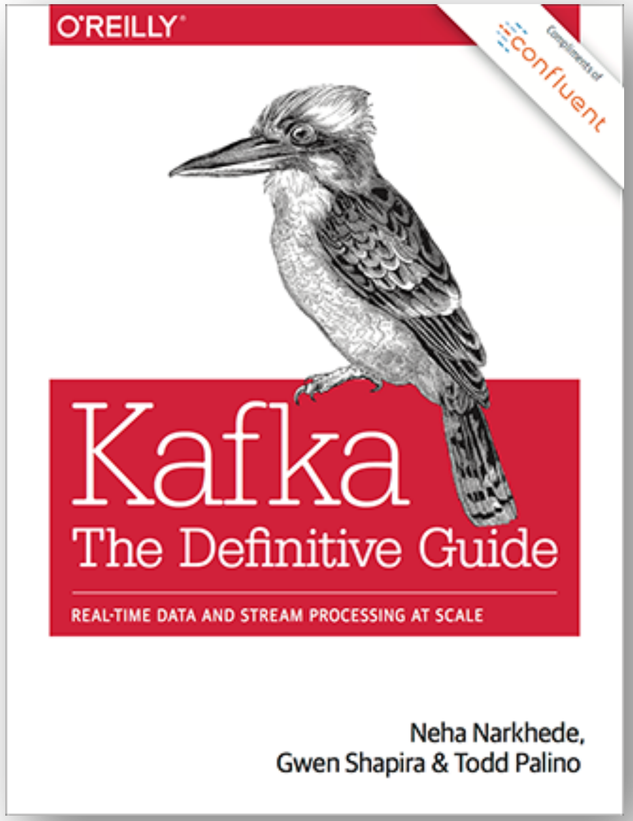
are

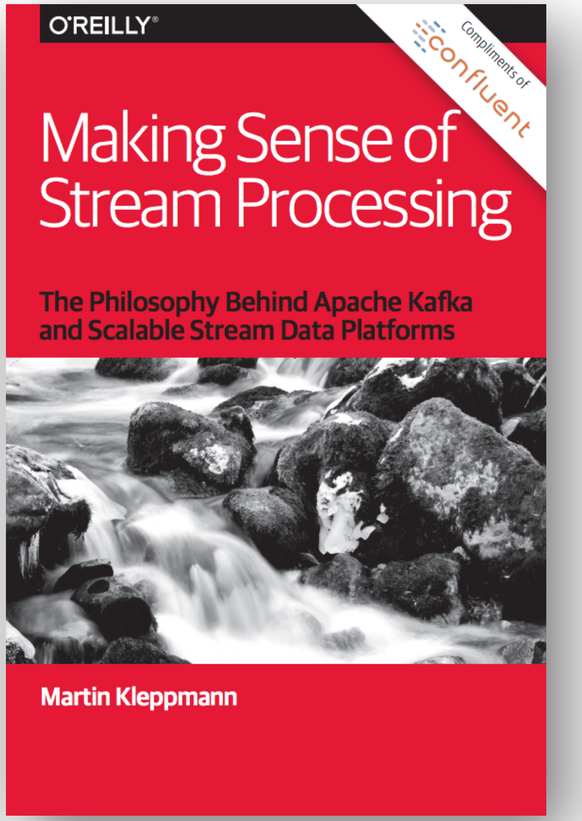
very POWERFUL

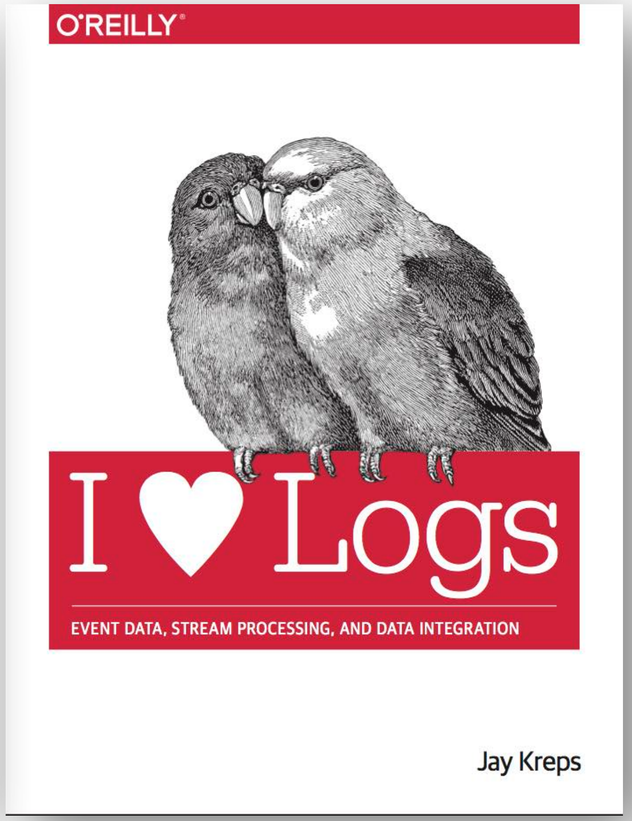
Standby for resource links...

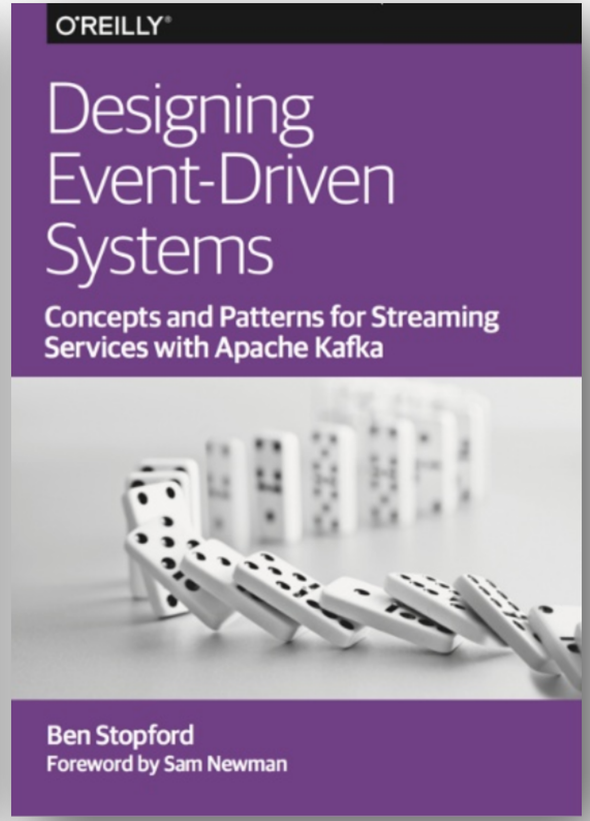
Free Books!

https://rmoff.dev/ndcoslo2020









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